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(54) **SYSTEM, METHOD AND APPARATUS FOR REMOTE MONITORING**

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(56) **References Cited**

U.S. PATENT DOCUMENTS

686,838	A	11/1901	Richard
4,141,006	A	2/1979	Braxton

(Continued)

FOREIGN PATENT DOCUMENTS

AU	2005223267	B2	12/2010
AU	2010297957	A1	5/2012

(Continued)

OTHER PUBLICATIONS

Alarm.com—Interactive Security Systems, Elders [retrieved on Nov. 4, 2003], 1 page.

(Continued)

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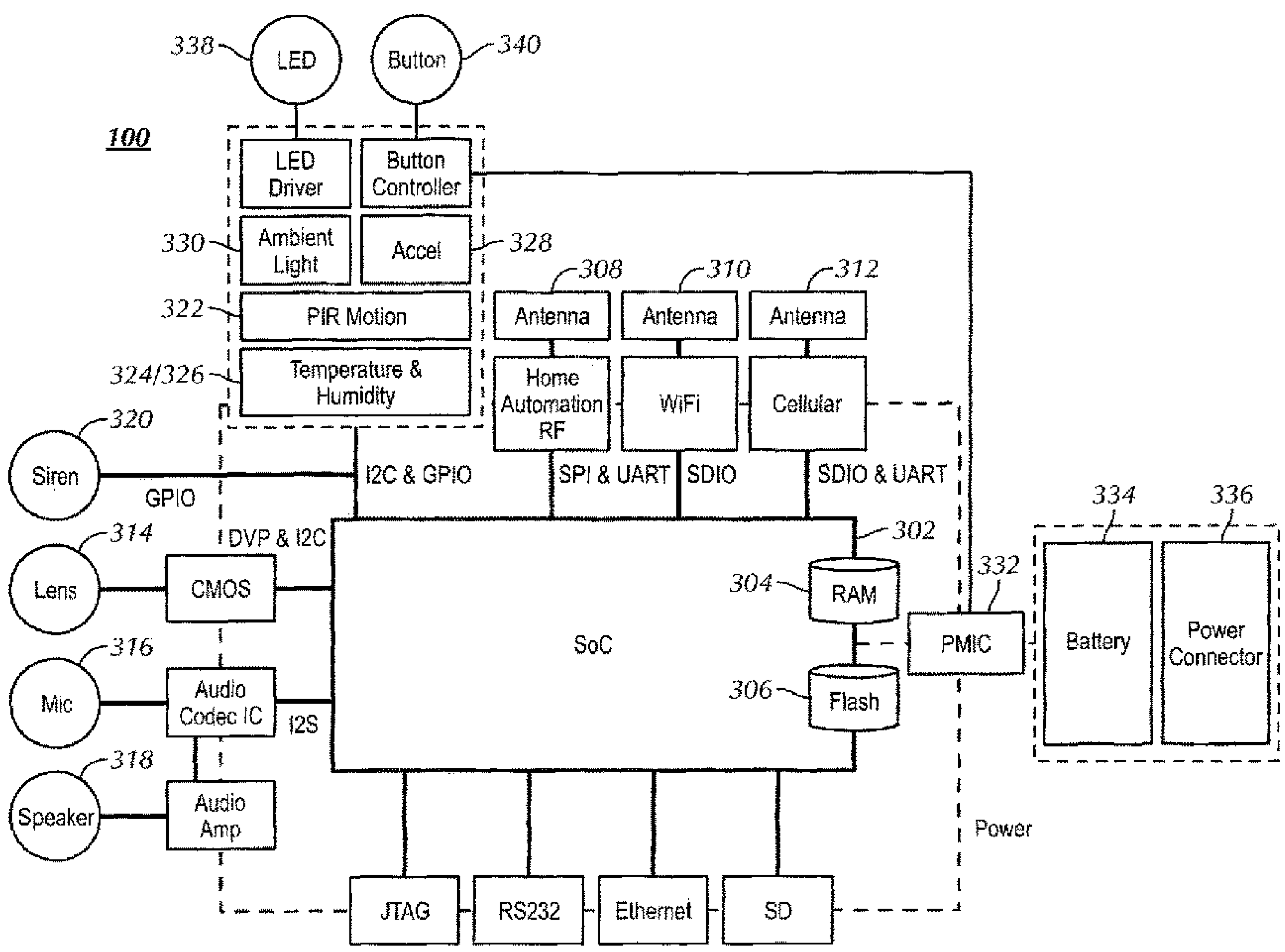
(57) **ABSTRACT**

A monitoring unit for security and automation in a premises are described. The monitoring unit uses remote configuration and control to enable monitoring of a premises. The monitoring unit provides multiple monitoring functions to respond to events within the space and alert a user at a remote device like a smartphone. An image sensor provides a wide field of view which can be segmented on the mobile device to enable specific areas to be viewed enabling the user to view the area and be alerted when an event occurs based upon a rules based configuration.

27 Claims, 20 Drawing Sheets



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(56) **References Cited**

U.S. PATENT DOCUMENTS

4,257,038	A		3/1981	Rounds et al.	
4,363,031	A		12/1982	Reinowitz	
4,520,503	A		5/1985	Kirst et al.	
4,559,526	A		12/1985	Tani et al.	
4,574,305	A		3/1986	Campbell et al.	
4,581,606	A		4/1986	Mallory	
D284,084	S		6/1986	Ferrara, Jr.	
4,641,127	A		2/1987	Hogan et al.	
4,652,859	A		3/1987	Van Wienen	
4,694,282	A		9/1987	Tamura et al.	
4,730,184	A		3/1988	Bach	
4,754,261	A		6/1988	Marino	
4,779,007	A		10/1988	Schlanger et al.	
4,801,924	A		1/1989	Burgmann et al.	
4,812,820	A		3/1989	Chatwin	
4,833,449	A		5/1989	Gaffigan	
4,855,713	A		8/1989	Brunius	
4,860,185	A		8/1989	Brewer et al.	
4,897,630	A		1/1990	Nykerk	
4,918,623	A		4/1990	Lockitt et al.	
4,951,029	A		8/1990	Severson	
4,959,713	A		9/1990	Morotomi et al.	
4,993,059	A		2/1991	Smith et al.	
4,994,787	A		2/1991	Kratt et al.	
5,023,901	A		6/1991	Sloan et al.	
5,086,385	A		2/1992	Launey et al.	
5,091,780	A		2/1992	Pomerleau	
5,111,288	A	*	5/1992	Blackshear	G08B 13/19619 348/143
5,132,968	A		7/1992	Cephus	
5,134,644	A		7/1992	Garton et al.	
5,159,315	A		10/1992	Schultz et al.	
5,160,879	A		11/1992	Tortola et al.	
D337,569	S		7/1993	Kando	
5,227,776	A		7/1993	Starefoss	
5,237,305	A		8/1993	Ishikuro et al.	
5,299,971	A	*	4/1994	Hart	G08B 13/1963 180/167
5,319,394	A		6/1994	Dukek	
5,319,698	A		6/1994	Glidewell et al.	
5,334,974	A		8/1994	Simms et al.	
5,359,363	A	*	10/1994	Kuban	G06T 3/0018 348/36
5,438,607	A		8/1995	Przygoda, Jr. et al.	
5,446,445	A		8/1995	Bloomfield et al.	
5,465,081	A		11/1995	Todd	
5,471,194	A		11/1995	Guscott	
5,486,812	A		1/1996	Todd	
5,499,014	A		3/1996	Greenwaldt	
5,499,196	A		3/1996	Pacheco	
5,519,878	A		5/1996	Dolin, Jr.	
5,578,989	A		11/1996	Pedtke	
5,579,197	A		11/1996	Mengelt et al.	

D377,034	S	12/1996	Matsushita
5,587,705	A	12/1996	Morris
5,623,601	A	4/1997	Vu
5,625,338	A	4/1997	Pildner et al.
5,630,216	A	5/1997	McEwan
5,651,070	A	7/1997	Blunt
D389,501	S	1/1998	Mascarenas, Sr. et al.
5,715,394	A	2/1998	Jabs
5,717,379	A	2/1998	Peters
5,717,578	A	2/1998	Afzal
5,731,756	A	3/1998	Roddy
5,777,551	A	7/1998	Hess
5,838,996	A	11/1998	deCarmo
5,874,952	A	2/1999	Morgan
5,886,894	A	3/1999	Rakoff
5,892,442	A	4/1999	Ozery
5,907,279	A	5/1999	Bruins et al.
5,909,183	A	6/1999	Borgstahl et al.
5,914,655	A	6/1999	Clifton et al.
5,943,394	A	8/1999	Ader et al.
5,955,946	A	9/1999	Beheshti et al.
5,958,053	A	9/1999	Denker
5,959,528	A	9/1999	Right et al.
5,963,916	A	10/1999	Kaplan
D416,910	S	11/1999	Vasquez
5,991,795	A	11/1999	Howard et al.
6,032,036	A	2/2000	Maystre et al.
6,037,991	A	3/2000	Thro et al.
6,038,289	A	3/2000	Sands
6,040,770	A	3/2000	Britton
6,049,272	A	4/2000	Lee et al.
6,049,273	A	4/2000	Hess
6,052,052	A	4/2000	Delmonaco
6,060,994	A	5/2000	Chen
6,067,346	A	5/2000	Akhteruzzaman et al.
6,067,440	A	5/2000	Diefes
6,078,253	A	6/2000	Fowler
6,078,257	A	6/2000	Ferraro
6,085,030	A	7/2000	Whitehead et al.
6,104,785	A	8/2000	Chen
6,134,591	A	10/2000	Nickles
6,138,249	A	10/2000	Nolet
6,140,987	A	10/2000	Stein et al.
6,181,341	B1	1/2001	Shinagawa
6,192,418	B1	2/2001	Hale et al.
6,198,475	B1	3/2001	Kunimatsu et al.
6,198,479	B1	3/2001	Humpleman et al.
6,208,247	B1	3/2001	Agre et al.
6,211,783	B1	4/2001	Wang
6,219,677	B1	4/2001	Howard
6,246,320	B1	6/2001	Monroe
6,271,752	B1	8/2001	Vaios
6,281,790	B1	8/2001	Kimmel et al.
6,282,569	B1	8/2001	Wallis et al.
6,286,038	B1	9/2001	Reichmeyer et al.
6,288,716	B1	9/2001	Humpleman et al.
6,289,382	B1	9/2001	Bowman-Amuah
6,295,346	B1	9/2001	Markowitz et al.
6,320,506	B1	11/2001	Ferraro
D451,529	S	12/2001	Vasquez
6,331,122	B1	12/2001	Wu
6,351,829	B1	2/2002	Dupont et al.
6,353,891	B1	3/2002	Borella et al.
6,363,417	B1	3/2002	Howard et al.
6,363,422	B1	3/2002	Hunter et al.
6,369,695	B1	4/2002	Horon
6,369,705	B1	4/2002	Kennedy
6,370,436	B1	4/2002	Howard et al.
6,374,079	B1	4/2002	Hsu
6,377,861	B1	4/2002	York
6,385,772	B1	5/2002	Courtney
6,400,265	B1	6/2002	Saylor et al.
D460,472	S	7/2002	Wang
6,418,037	B1	7/2002	Zhang
6,433,683	B1	8/2002	Robinson
D464,328	S	10/2002	Vasquez et al.
D464,948	S	10/2002	Vasquez et al.
6,462,507	B2	10/2002	Fisher et al.
6,462,663	B1	10/2002	Wilson et al.

(56) References Cited

U.S. PATENT DOCUMENTS

6,467,084 B1 10/2002 Howard et al.
6,480,901 B1 11/2002 Weber et al.
6,493,020 B1 12/2002 Stevenson et al.
6,496,927 B1 12/2002 McGrane et al.
6,529,723 B1 3/2003 Bentley
6,542,075 B2 4/2003 Barker et al.
6,553,336 B1 4/2003 Johnson et al.
6,563,800 B1 5/2003 Salo et al.
6,574,234 B1 6/2003 Myer et al.
6,580,950 B1 6/2003 Johnson et al.
6,587,455 B1 7/2003 Ray et al.
6,587,736 B2 7/2003 Howard et al.
6,591,094 B1 7/2003 Bentley
6,597,703 B1 7/2003 Li et al.
6,601,086 B1 7/2003 Howard et al.
6,603,488 B2 8/2003 Humpleman et al.
6,609,127 B1 8/2003 Lee et al.
6,615,088 B1 9/2003 Myer et al.
6,621,827 B1 9/2003 Rezvani et al.
6,624,750 B1 9/2003 Marman et al.
6,631,416 B2 10/2003 Bendinelli et al.
6,636,893 B1 10/2003 Fong
6,643,652 B2 11/2003 Helgeson et al.
6,643,669 B1 11/2003 Novak et al.
6,648,682 B1 11/2003 Wu
6,658,091 B1 12/2003 Naidoo et al.
6,661,340 B1 12/2003 Saylor et al.
6,686,838 B1 2/2004 Rezvani et al.
6,690,411 B2 2/2004 Naidoo et al.
6,693,530 B1 2/2004 Dowens et al.
6,693,545 B2 2/2004 Brown et al.
6,697,103 B1 2/2004 Fernandez et al.
6,704,786 B1 3/2004 Gupta et al.
6,721,689 B2 4/2004 Markle et al.
6,721,747 B2 4/2004 Lipkin
6,738,824 B1 5/2004 Blair
6,754,717 B1 6/2004 Day, III et al.
6,756,896 B2 6/2004 Ford
6,756,998 B1 6/2004 Bilger
6,762,686 B1 7/2004 Tabe
6,778,085 B2 8/2004 Faulkner et al.
6,781,509 B1 8/2004 Oppedahl et al.
6,785,542 B1 8/2004 Blight et al.
6,789,147 B1 9/2004 Kessler et al.
6,795,322 B2 9/2004 Aihara et al.
6,798,344 B2 9/2004 Faulkner et al.
6,810,409 B1 10/2004 Fry et al.
6,826,233 B1 11/2004 Oosawa
6,850,252 B1 2/2005 Hoffberg
6,856,236 B2 2/2005 Christensen et al.
6,865,690 B2 3/2005 Kocin
6,873,256 B2 3/2005 Lemelson et al.
D504,889 S 5/2005 Andre et al.
6,891,838 B1 5/2005 Petite et al.
6,912,429 B1 6/2005 Bilger
6,918,112 B2 7/2005 Bourke-Dunphy et al.
6,928,148 B2 8/2005 Simon et al.
6,930,599 B2 8/2005 Naidoo et al.
6,930,730 B2 8/2005 Maxon et al.
6,931,445 B2 8/2005 Davis
6,943,681 B2 9/2005 Rezvani et al.
6,956,477 B2 10/2005 Chun
6,959,341 B1 10/2005 Leung
6,959,393 B2 10/2005 Hollis et al.
6,963,981 B1 11/2005 Bailey et al.
6,965,313 B1 11/2005 Saylor et al.
6,970,183 B1 11/2005 Monroe
6,972,676 B1 12/2005 Kimmel et al.
6,975,220 B1 12/2005 Foodman et al.
6,977,485 B1 12/2005 Wei
6,990,591 B1 1/2006 Pearson
7,015,806 B2 3/2006 Naidoo et al.
7,016,970 B2 3/2006 Harumoto et al.
7,020,697 B1 3/2006 Goodman et al.
7,020,701 B1 3/2006 Gelvin et al.
7,024,676 B1 4/2006 Klopfenstein
7,030,752 B2 4/2006 Tyroler
7,032,002 B1 4/2006 Rezvani et al.
7,034,681 B2 4/2006 Yamamoto et al.
7,035,907 B1 4/2006 Decasper et al.
7,039,391 B2 5/2006 Rezvani et al.
7,043,537 B1 5/2006 Pratt
7,047,088 B2 5/2006 Nakamura et al.
7,047,092 B2 5/2006 Wimsatt
7,053,764 B2 5/2006 Stilp
7,072,934 B2 7/2006 Helgeson et al.
7,075,429 B2 7/2006 Marshall
7,079,020 B2 7/2006 Stilp
7,080,046 B1 7/2006 Rezvani et al.
7,081,813 B2 7/2006 Winick et al.
7,082,460 B2 7/2006 Hansen et al.
7,085,937 B1 8/2006 Rezvani et al.
7,099,944 B1 8/2006 Anschutz et al.
7,099,994 B2 8/2006 Thayer et al.
7,103,152 B2 9/2006 Naidoo et al.
7,106,176 B2 9/2006 La et al.
7,107,322 B1 9/2006 Freeny, Jr.
7,110,774 B1 9/2006 Davis et al.
7,113,090 B1 9/2006 Saylor et al.
7,113,099 B2 9/2006 Tyroler et al.
7,114,554 B2 10/2006 Bergman et al.
7,119,674 B2 10/2006 Sefton
7,120,232 B2 10/2006 Naidoo et al.
7,120,233 B2 10/2006 Naidoo et al.
7,130,383 B2 10/2006 Naidoo et al.
7,130,585 B1 10/2006 Ollis et al.
7,148,810 B2 12/2006 Bhat
7,149,798 B2 12/2006 Rezvani et al.
7,149,814 B2 12/2006 Neufeld et al.
7,164,907 B2 1/2007 Cochran et al.
7,166,987 B2 1/2007 Lee et al.
7,174,564 B1 2/2007 Weatherspoon et al.
7,183,907 B2 2/2007 Simon et al.
7,203,486 B2 4/2007 Patel
7,209,945 B2 4/2007 Hicks et al.
7,212,570 B2 5/2007 Akiyama et al.
7,218,217 B2 5/2007 Adonailo et al.
7,222,359 B2 5/2007 Freund et al.
7,237,267 B2 6/2007 Rayes et al.
7,248,161 B2 7/2007 Spoltore et al.
7,249,317 B1 7/2007 Nakagawa et al.
7,250,854 B2 7/2007 Rezvani et al.
7,250,859 B2 7/2007 Martin et al.
7,254,779 B1 8/2007 Rezvani et al.
7,262,690 B2 8/2007 Heaton et al.
7,277,010 B2 * 10/2007 Joao B60R 25/102
340/539.14
7,298,253 B2 11/2007 Petricoin et al.
7,305,461 B2 12/2007 Ullman
7,310,115 B2 12/2007 Tanimoto
7,313,102 B2 12/2007 Stephenson et al.
D558,460 S 1/2008 Yu et al.
D558,756 S 1/2008 Andre et al.
7,337,217 B2 2/2008 Wang
7,337,473 B2 2/2008 Chang et al.
7,343,619 B2 3/2008 Ofek et al.
7,349,761 B1 3/2008 Cruse
7,349,967 B2 3/2008 Wang
7,367,045 B2 4/2008 Ofek et al.
7,370,115 B2 5/2008 Bae et al.
7,383,339 B1 6/2008 Meenan et al.
7,403,838 B2 7/2008 Deen et al.
7,409,045 B2 8/2008 Naidoo et al.
7,409,451 B1 8/2008 Meenan et al.
7,412,447 B2 8/2008 Hilbert et al.
7,425,101 B2 9/2008 Cheng
7,428,585 B1 9/2008 Owens, II et al.
7,430,614 B2 9/2008 Shen et al.
7,437,753 B2 10/2008 Nahum
7,440,434 B2 10/2008 Chaskar et al.
7,457,869 B2 11/2008 Kernan
7,469,139 B2 12/2008 Van
7,469,294 B1 12/2008 Luo et al.
7,469,381 B2 12/2008 Ording

(56) **References Cited**

U.S. PATENT DOCUMENTS

D584,738 S 1/2009 Kim et al.
D585,399 S 1/2009 Hwang
7,479,949 B2 1/2009 Jobs et al.
7,480,713 B2 1/2009 Ullman
7,480,724 B2 1/2009 Zimler et al.
7,498,695 B2 3/2009 Gaudreau et al.
7,506,052 B2 3/2009 Qian et al.
7,509,687 B2 3/2009 Ofek et al.
7,511,614 B2 3/2009 Stilp et al.
7,512,965 B1 3/2009 Amdur et al.
7,526,539 B1 4/2009 Hsu
7,526,762 B1 4/2009 Astala et al.
7,528,723 B2 5/2009 Fast et al.
7,551,071 B2 6/2009 Bennett, III
7,554,934 B2 6/2009 Abraham et al.
7,558,379 B2 7/2009 Winick
7,568,018 B1 7/2009 Hove et al.
7,571,459 B2 8/2009 Ganesh et al.
7,577,420 B2 * 8/2009 Srinivasan G08B 25/006 455/404.1
7,587,464 B2 9/2009 Moorer et al.
D602,014 S 10/2009 Andre et al.
D602,015 S 10/2009 Andre et al.
D602,017 S 10/2009 Andre et al.
D602,486 S 10/2009 Andre et al.
D602,487 S 10/2009 Maskatia
7,619,512 B2 11/2009 Trundle et al.
7,620,427 B2 11/2009 Shanahan
7,627,665 B2 12/2009 Barker et al.
7,633,385 B2 12/2009 Cohn et al.
7,634,519 B2 12/2009 Creamer et al.
7,651,530 B2 1/2010 Winick
7,653,911 B2 1/2010 Doshi et al.
7,681,201 B2 3/2010 Dale et al.
7,697,028 B1 4/2010 Johnson
7,701,970 B2 4/2010 Krits et al.
D615,083 S 5/2010 Andre et al.
7,711,796 B2 5/2010 Gutt et al.
7,734,020 B2 6/2010 Elliot et al.
7,734,286 B2 6/2010 Almeda et al.
7,734,906 B2 6/2010 Orlando et al.
7,739,596 B2 6/2010 Clarke-Martin et al.
7,751,409 B1 7/2010 Carolan
7,787,863 B2 8/2010 Groenendaal et al.
D624,896 S 10/2010 Park et al.
D626,437 S 11/2010 Lee et al.
7,827,252 B2 11/2010 Hopmann et al.
7,855,635 B2 12/2010 Cohn et al.
7,859,404 B2 12/2010 Chul et al.
7,882,537 B2 2/2011 Okajo et al.
7,884,855 B2 2/2011 Ortiz
7,890,612 B2 2/2011 Todd et al.
7,911,341 B2 3/2011 Raji et al.
D636,769 S 4/2011 Wood et al.
7,921,686 B2 4/2011 Bagepalli et al.
D637,596 S 5/2011 Akana et al.
D639,805 S 6/2011 Song et al.
D640,663 S 6/2011 Arnholt et al.
7,956,736 B2 6/2011 Cohn et al.
7,970,863 B1 6/2011 Fontaine
D641,018 S 7/2011 Lee et al.
7,974,235 B2 7/2011 Ghozati et al.
D642,563 S 8/2011 Akana et al.
8,001,219 B2 8/2011 Moorer et al.
D645,015 S 9/2011 Lee et al.
D645,435 S 9/2011 Kim et al.
D645,833 S 9/2011 Seflic et al.
8,022,833 B2 9/2011 Cho
8,028,041 B2 9/2011 Olliphant et al.
8,042,049 B2 10/2011 Killian et al.
8,046,411 B2 10/2011 Hayashi et al.
D650,381 S 12/2011 Park et al.
8,073,931 B2 12/2011 Dawes et al.
8,086,702 B2 * 12/2011 Baum H04L 12/2803 709/219
8,086,703 B2 * 12/2011 Baum H04L 12/2809 709/219
D654,460 S 2/2012 Kim et al.
D654,497 S 2/2012 Lee
8,122,131 B2 * 2/2012 Baum H04L 12/2809 709/219
8,125,184 B2 2/2012 Raji et al.
D656,137 S 3/2012 Chung et al.
8,140,658 B1 3/2012 Gelvin et al.
8,159,519 B2 4/2012 Kurtz et al.
8,200,827 B1 6/2012 Hunyady et al.
8,209,400 B2 * 6/2012 Baum G06F 17/30017 709/203
D663,298 S 7/2012 Song et al.
D664,540 S 7/2012 Kim et al.
8,214,496 B2 7/2012 Gutt et al.
D664,954 S 8/2012 Kim et al.
D666,198 S 8/2012 Van et al.
8,239,477 B2 8/2012 Sharma et al.
D667,395 S 9/2012 Lee
D667,396 S 9/2012 Koh
D667,397 S 9/2012 Koh
D667,398 S 9/2012 Koh
D667,399 S 9/2012 Koh
8,269,623 B2 9/2012 Addy et al.
D668,650 S 10/2012 Han
D668,651 S 10/2012 Kim et al.
D668,652 S 10/2012 Kim et al.
D669,469 S 10/2012 Kang
D670,692 S 11/2012 Akana et al.
D671,514 S 11/2012 Kim et al.
8,311,526 B2 11/2012 Forstall et al.
D671,938 S 12/2012 Hsu et al.
D672,344 S 12/2012 Li
D672,345 S 12/2012 Li
D672,739 S 12/2012 Sin
D672,768 S 12/2012 Huang et al.
8,335,842 B2 12/2012 Raji et al.
8,335,854 B2 12/2012 Eldering
D673,561 S 1/2013 Hyun et al.
D673,948 S 1/2013 Andre et al.
D673,950 S 1/2013 Li et al.
D674,369 S 1/2013 Jaewoong
D675,203 S 1/2013 Yang
D675,588 S 2/2013 Park
D675,612 S 2/2013 Andre et al.
D676,443 S 2/2013 Canizares et al.
D676,819 S 2/2013 Choi
D677,255 S 3/2013 McManigal et al.
D677,640 S 3/2013 Kim et al.
D677,659 S 3/2013 Akana et al.
D677,660 S 3/2013 Groene et al.
D678,271 S 3/2013 Chiu
D678,272 S 3/2013 Groene et al.
D678,877 S 3/2013 Groene et al.
D679,706 S 4/2013 Tang et al.
D680,151 S 4/2013 Katori
D680,524 S 4/2013 Feng et al.
D681,032 S 4/2013 Akana et al.
D681,583 S 5/2013 Park
D681,591 S 5/2013 Sung
D681,632 S 5/2013 Akana et al.
D682,239 S 5/2013 Yeh et al.
8,451,986 B2 5/2013 Cohn et al.
D684,553 S 6/2013 Kim et al.
D684,968 S 6/2013 Smith et al.
8,473,619 B2 * 6/2013 Baum G08B 25/14 706/46
D685,778 S 7/2013 Fahrendorff et al.
D685,783 S 7/2013 Bryan et al.
8,478,844 B2 7/2013 Baum et al.
8,478,871 B2 7/2013 Gutt et al.
8,483,853 B1 7/2013 Lambourne
8,499,038 B1 7/2013 Vucurevich
8,520,068 B2 8/2013 Naidoo et al.
8,525,664 B2 9/2013 Hadizad et al.
8,543,665 B2 9/2013 Ansari et al.
8,570,993 B2 * 10/2013 Austin H04W 4/02 370/338

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,584,199	B1	11/2013	Chen et al.	
8,612,591	B2	12/2013	Dawes et al.	
8,675,071	B1	3/2014	Slavin et al.	
8,730,834	B2	5/2014	Marusca et al.	
8,836,467	B1 *	9/2014	Cohn	G08B 25/003 340/3.32
8,902,740	B2 *	12/2014	Hicks, III	G08B 25/004 370/229
8,914,526	B1	12/2014	Lindquist et al.	
8,935,236	B2	1/2015	Morita et al.	
9,529,440	B2	12/2016	Piemonte	
2001/0016501	A1	8/2001	King	
2001/0030597	A1	10/2001	Inoue et al.	
2001/0034754	A1	10/2001	Elwahab et al.	
2002/0004828	A1	1/2002	Davis et al.	
2002/0026476	A1	2/2002	Miyazaki et al.	
2002/0026531	A1	2/2002	Keane et al.	
2002/0027504	A1	3/2002	Davis et al.	
2002/0029276	A1	3/2002	Bendinelli et al.	
2002/0038380	A1	3/2002	Brawn et al.	
2002/0052913	A1	5/2002	Yamada et al.	
2002/0059637	A1	5/2002	Rakib	
2002/0083342	A1	6/2002	Webb et al.	
2002/0095490	A1	7/2002	Barker et al.	
2002/0099809	A1	7/2002	Lee	
2002/0099829	A1	7/2002	Richards et al.	
2002/0103898	A1	8/2002	Moyer et al.	
2002/0103927	A1	8/2002	Parent	
2002/0107910	A1	8/2002	Zhao	
2002/0109580	A1	8/2002	Shreve et al.	
2002/0111698	A1	8/2002	Graziano et al.	
2002/0112051	A1	8/2002	Ullman	
2002/0112182	A1	8/2002	Chang et al.	
2002/0114439	A1	8/2002	Dunlap	
2002/0116117	A1	8/2002	Martens et al.	
2002/0118107	A1	8/2002	Yamamoto et al.	
2002/0120790	A1	8/2002	Schwalb	
2002/0128728	A1	9/2002	Murakami et al.	
2002/0133539	A1	9/2002	Monday	
2002/0133578	A1	9/2002	Wu	
2002/0143923	A1	10/2002	Alexander	
2002/0147982	A1	10/2002	Naidoo et al.	
2002/0156564	A1	10/2002	Preston et al.	
2002/0163534	A1	11/2002	Choi et al.	
2002/0163997	A1	11/2002	Bergman et al.	
2002/0165006	A1	11/2002	Haller et al.	
2002/0174367	A1	11/2002	Kimmel et al.	
2002/0177428	A1	11/2002	Menard et al.	
2002/0180579	A1	12/2002	Nagaoka et al.	
2002/0184301	A1	12/2002	Parent	
2003/0005030	A1	1/2003	Sutton et al.	
2003/0009552	A1	1/2003	Benfield et al.	
2003/0009553	A1	1/2003	Benfield et al.	
2003/0023839	A1	1/2003	Burkhardt et al.	
2003/0030548	A1	2/2003	Kovacs et al.	
2003/0038849	A1	2/2003	Craven et al.	
2003/0041137	A1	2/2003	Horie et al.	
2003/0041167	A1	2/2003	French et al.	
2003/0051009	A1	3/2003	Shah et al.	
2003/0052923	A1	3/2003	Porter	
2003/0061344	A1	3/2003	Monroe	
2003/0062997	A1	4/2003	Naidoo et al.	
2003/0065757	A1	4/2003	Mentze et al.	
2003/0071724	A1	4/2003	D'Amico	
2003/0090473	A1	5/2003	Joshi	
2003/0103088	A1	6/2003	Dresti et al.	
2003/0115345	A1	6/2003	Chien et al.	
2003/0128115	A1	7/2003	Giacopelli et al.	
2003/0132018	A1	7/2003	Okita et al.	
2003/0137426	A1	7/2003	Anthony et al.	
2003/0147534	A1	8/2003	Ablay et al.	
2003/0158635	A1	8/2003	Pillar et al.	
2003/0159135	A1	8/2003	Hiller et al.	
2003/0174648	A1	9/2003	Wang et al.	
2003/0177236	A1	9/2003	Goto et al.	
2003/0182396	A1	9/2003	Reich et al.	
2003/0187920	A1	10/2003	Redkar	
2003/0189509	A1	10/2003	Hayes et al.	
2003/0197847	A1	10/2003	Shinoda	
2003/0200325	A1	10/2003	Krishnaswamy et al.	
2003/0201889	A1	10/2003	Zulkowski	
2003/0210126	A1	11/2003	Kanazawa	
2003/0217136	A1	11/2003	Cho et al.	
2003/0230934	A1	12/2003	Cordelli et al.	
2003/0236841	A1	12/2003	Epshteyn	
2004/0003241	A1	1/2004	Sengodan et al.	
2004/0015572	A1	1/2004	Kang	
2004/0024851	A1	2/2004	Naidoo et al.	
2004/0037295	A1	2/2004	Tanaka et al.	
2004/0054789	A1	3/2004	Breh et al.	
2004/0086088	A1	5/2004	Naidoo et al.	
2004/0086090	A1	5/2004	Naidoo et al.	
2004/0086093	A1	5/2004	Schranz	
2004/0103308	A1	5/2004	Paller	
2004/0117330	A1	6/2004	Ehlers et al.	
2004/0117462	A1	6/2004	Bodin et al.	
2004/0117465	A1	6/2004	Bodin et al.	
2004/0123149	A1	6/2004	Tyroler	
2004/0139227	A1	7/2004	Takeda	
2004/0143749	A1	7/2004	Tajalli et al.	
2004/0155757	A1	8/2004	Litwin et al.	
2004/0162902	A1	8/2004	Davis	
2004/0163073	A1	8/2004	Krzyzanowski et al.	
2004/0163118	A1	8/2004	Mottur	
2004/0169288	A1	9/2004	Hsieh et al.	
2004/0177163	A1	9/2004	Casey et al.	
2004/0189460	A1	9/2004	Heaton et al.	
2004/0189871	A1	9/2004	Kurosawa et al.	
2004/0196844	A1	10/2004	Hagino	
2004/0199645	A1	10/2004	Rouhi	
2004/0202351	A1	10/2004	Park et al.	
2004/0212503	A1	10/2004	Stilp	
2004/0215694	A1	10/2004	Podolsky	
2004/0215700	A1	10/2004	Shenfield et al.	
2004/0223605	A1	11/2004	Donnelly	
2004/0243835	A1	12/2004	Terzis et al.	
2004/0243996	A1	12/2004	Sheehy et al.	
2004/0246339	A1	12/2004	Ooshima et al.	
2004/0249922	A1	12/2004	Hackman et al.	
2004/0257433	A1	12/2004	Lia et al.	
2004/0260407	A1	12/2004	Wimsatt	
2004/0260427	A1	12/2004	Wimsatt	
2004/0267937	A1	12/2004	Klemets	
2005/0010866	A1	1/2005	Humpleman et al.	
2005/0015805	A1	1/2005	Iwamura	
2005/0023858	A1	2/2005	Bingle et al.	
2005/0024203	A1	2/2005	Wolfe	
2005/0038325	A1	2/2005	Moll	
2005/0038326	A1	2/2005	Mathur	
2005/0044061	A1	2/2005	Klemow	
2005/0052831	A1	3/2005	Chen	
2005/0060411	A1	3/2005	Coulombe et al.	
2005/0066045	A1	3/2005	Johnson et al.	
2005/0069098	A1	3/2005	Kalervo et al.	
2005/0079855	A1	4/2005	Jethi et al.	
2005/0086126	A1	4/2005	Patterson	
2005/0086211	A1	4/2005	Mayer	
2005/0091696	A1	4/2005	Wolfe et al.	
2005/0096753	A1	5/2005	Arling et al.	
2005/0102152	A1	5/2005	Hodges	
2005/0108091	A1	5/2005	Sotak et al.	
2005/0108369	A1	5/2005	Sather et al.	
2005/0120082	A1	6/2005	Hesselink	
2005/0125083	A1 *	6/2005	Kiko	G05B 15/02 700/19
2005/0128068	A1	6/2005	Winick et al.	
2005/0128083	A1	6/2005	Puzio et al.	
2005/0144312	A1	6/2005	Kadyk et al.	
2005/0149639	A1	7/2005	Vrielink et al.	
2005/0149746	A1	7/2005	Lu et al.	
2005/0156568	A1	7/2005	Yueh	
2005/0159823	A1	7/2005	Hayes et al.	
2005/0169288	A1	8/2005	Kamiwada et al.	
2005/0184865	A1	8/2005	Han et al.	

(56) **References Cited**

U.S. PATENT DOCUMENTS

2005/0197847	A1	9/2005	Smith
2005/0200474	A1*	9/2005	Behnke G08B 25/14 340/521
2005/0204076	A1	9/2005	Cumpson
2005/0210532	A1	9/2005	Winick
2005/0216302	A1	9/2005	Raji et al.
2005/0216580	A1	9/2005	Raji et al.
2005/0222820	A1	10/2005	Chung et al.
2005/0225442	A1	10/2005	Kanayanna
2005/0231349	A1	10/2005	Bhat
2005/0237182	A1	10/2005	Wang
2005/0249199	A1	11/2005	Albert et al.
2005/0256608	A1	11/2005	King et al.
2005/0267605	A1	12/2005	Lee et al.
2005/0273831	A1	12/2005	Slomovich et al.
2005/0276389	A1	12/2005	Hinkson et al.
2005/0280964	A1	12/2005	Richmond et al.
2006/0009863	A1	1/2006	Lingemann
2006/0010078	A1	1/2006	Rezvani et al.
2006/0018328	A1	1/2006	Mody et al.
2006/0045074	A1	3/2006	Lee
2006/0051122	A1	3/2006	Kawazu et al.
2006/0063534	A1	3/2006	Kokkonen et al.
2006/0064305	A1	3/2006	Alonso
2006/0064478	A1	3/2006	Sirkin
2006/0067344	A1	3/2006	Sakurai
2006/0067484	A1	3/2006	Elliot et al.
2006/0075235	A1	4/2006	Renkis
2006/0078344	A1	4/2006	Kawazu et al.
2006/0088092	A1	4/2006	Chen et al.
2006/0098168	A1*	5/2006	McDowall G03B 21/625 353/70
2006/0105713	A1	5/2006	Zheng et al.
2006/0109113	A1	5/2006	Reyes et al.
2006/0111095	A1	5/2006	Weigand
2006/0129837	A1	6/2006	Im et al.
2006/0132302	A1	6/2006	Stilp
2006/0142880	A1	6/2006	Deen et al.
2006/0142968	A1	6/2006	Han et al.
2006/0143268	A1	6/2006	Chatani
2006/0145842	A1	7/2006	Stilp
2006/0161270	A1	7/2006	Luskin et al.
2006/0161662	A1	7/2006	Ng et al.
2006/0161960	A1	7/2006	Benoit
2006/0167784	A1	7/2006	Hoffberg
2006/0168178	A1	7/2006	Hwang et al.
2006/0181406	A1	8/2006	Petite et al.
2006/0182100	A1	8/2006	Li et al.
2006/0183460	A1*	8/2006	Srinivasan G08B 25/006 455/410
2006/0187900	A1	8/2006	Akbar
2006/0190458	A1	8/2006	Mishina et al.
2006/0197660	A1	9/2006	Luebke et al.
2006/0200845	A1	9/2006	Foster et al.
2006/0206220	A1	9/2006	Amundson
2006/0209857	A1	9/2006	Hicks, III
2006/0218593	A1	9/2006	Afshary et al.
2006/0220830	A1	10/2006	Bennett, III
2006/0222153	A1	10/2006	Tarkoff et al.
2006/0229746	A1	10/2006	Ollis et al.
2006/0230270	A1	10/2006	Goffin
2006/0242395	A1	10/2006	Fausak
2006/0245369	A1	11/2006	Schimmelpfeng et al.
2006/0246919	A1	11/2006	Park et al.
2006/0258342	A1	11/2006	Fok et al.
2006/0265489	A1	11/2006	Moore
2006/0271695	A1	11/2006	Lavian
2006/0282886	A1	12/2006	Gaug
2007/0002833	A1	1/2007	Bajic
2007/0005736	A1	1/2007	Hansen et al.
2007/0005957	A1*	1/2007	Sahita G06F 21/554 713/156
2007/0006177	A1	1/2007	Aiber et al.
2007/0052675	A1	3/2007	Chang
2007/0055770	A1	3/2007	Karmakar et al.
2007/0061266	A1	3/2007	Moore et al.
2007/0063866	A1	3/2007	Webb
2007/0079151	A1	4/2007	Connor et al.
2007/0079385	A1	4/2007	Williams et al.
2007/0096981	A1	5/2007	Abraham
2007/0101345	A1	5/2007	Takagi
2007/0106124	A1	5/2007	Kuriyama et al.
2007/0130286	A1	6/2007	Hopmann et al.
2007/0142022	A1	6/2007	Madonna et al.
2007/0143440	A1	6/2007	Reckamp et al.
2007/0146484	A1	6/2007	Horton et al.
2007/0147419	A1	6/2007	Tsujimoto et al.
2007/0155325	A1	7/2007	Bambic et al.
2007/0160017	A1*	7/2007	Meier H04W 36/18 370/338
2007/0162228	A1	7/2007	Mitchell
2007/0162680	A1	7/2007	Mitchell et al.
2007/0192486	A1	8/2007	Wilson et al.
2007/0198698	A1	8/2007	Boyd et al.
2007/0216783	A1	9/2007	Ortiz et al.
2007/0223465	A1	9/2007	Wang et al.
2007/0226182	A1	9/2007	Sobotka et al.
2007/0230415	A1	10/2007	Malik
2007/0236595	A1*	10/2007	Pan G06T 3/0018 348/335
2007/0245223	A1	10/2007	Siedzik et al.
2007/0256105	A1	11/2007	Tabe
2007/0265866	A1	11/2007	Fehling et al.
2007/0271398	A1	11/2007	Manchester et al.
2007/0286210	A1	12/2007	Gutt et al.
2007/0286369	A1	12/2007	Gutt et al.
2007/0287405	A1	12/2007	Radtke
2007/0288849	A1	12/2007	Moorer et al.
2007/0290830	A1	12/2007	Gurley
2007/0298772	A1	12/2007	Owens et al.
2008/0001734	A1	1/2008	Stilp et al.
2008/0013957	A1	1/2008	Akers et al.
2008/0027587	A1	1/2008	Nickerson et al.
2008/0042826	A1	2/2008	Hevia et al.
2008/0048975	A1	2/2008	Leibow
2008/0065681	A1	3/2008	Fontijn et al.
2008/0072244	A1	3/2008	Eker et al.
2008/0084296	A1*	4/2008	Kutzik G06F 19/3418 340/540
2008/0091793	A1	4/2008	Diroo et al.
2008/0104516	A1	5/2008	Lee
2008/0109650	A1	5/2008	Shim et al.
2008/0112405	A1	5/2008	Cholas et al.
2008/0117029	A1	5/2008	Dohrmann et al.
2008/0126535	A1	5/2008	Zhu et al.
2008/0133725	A1	6/2008	Shaouy
2008/0141303	A1	6/2008	Walker et al.
2008/0141341	A1	6/2008	Vinogradov et al.
2008/0147834	A1	6/2008	Quinn et al.
2008/0163355	A1	7/2008	Chu
2008/0168404	A1	7/2008	Ording
2008/0170511	A1	7/2008	Shorty et al.
2008/0180240	A1	7/2008	Raji et al.
2008/0183842	A1	7/2008	Raji et al.
2008/0189609	A1	8/2008	Larson
2008/0219239	A1	9/2008	Bell et al.
2008/0235326	A1	9/2008	Parsi et al.
2008/0235600	A1	9/2008	Harper et al.
2008/0240372	A1	10/2008	Frenette
2008/0253391	A1	10/2008	Krits et al.
2008/0261540	A1	10/2008	Rohani et al.
2008/0284587	A1	11/2008	Saigh et al.
2008/0316024	A1	12/2008	Chantelou et al.
2009/0019141	A1	1/2009	Bush et al.
2009/0036142	A1	2/2009	Yan
2009/0041467	A1	2/2009	Carleton et al.
2009/0042649	A1	2/2009	Hsieh et al.
2009/0049488	A1	2/2009	Stransky
2009/0063582	A1	3/2009	Anna et al.
2009/0066788	A1	3/2009	Baum et al.
2009/0066789	A1	3/2009	Baum et al.
2009/0067395	A1	3/2009	Curtis et al.
2009/0070436	A1	3/2009	Dawes et al.
2009/0070473	A1	3/2009	Baum et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2009/0070477 A1 3/2009 Baum et al.
2009/0070681 A1 3/2009 Dawes et al.
2009/0070682 A1 3/2009 Dawes et al.
2009/0070692 A1 3/2009 Dawes et al.
2009/0074184 A1 3/2009 Baum et al.
2009/0077167 A1 3/2009 Baum et al.
2009/0077622 A1 3/2009 Baum et al.
2009/0077623 A1 3/2009 Baum et al.
2009/0077624 A1 3/2009 Baum et al.
2009/0100329 A1 4/2009 Espinoza
2009/0100492 A1 4/2009 Hicks, III et al.
2009/0113344 A1 4/2009 Nesse et al.
2009/0119397 A1 5/2009 Neerdaels
2009/0125708 A1 5/2009 Woodring et al.
2009/0128365 A1 5/2009 Laskin
2009/0134998 A1 5/2009 Baum et al.
2009/0138600 A1 5/2009 Baum et al.
2009/0138958 A1 5/2009 Baum et al.
2009/0146846 A1 6/2009 Grossman
2009/0158189 A1 6/2009 Itani
2009/0158292 A1 6/2009 Rattner et al.
2009/0165114 A1* 6/2009 Baum H04L 12/2803 726/12
2009/0177906 A1 7/2009 Paniagua, Jr. et al.
2009/0204693 A1 8/2009 Andreev et al.
2009/0221368 A1 9/2009 Yen et al.
2009/0240787 A1 9/2009 Denny
2009/0240814 A1 9/2009 Brubacher et al.
2009/0240946 A1 9/2009 Yeap et al.
2009/0256708 A1 10/2009 Hsiao et al.
2009/0265042 A1* 10/2009 Mollenkopf H02J 3/12 700/298
2009/0303100 A1 12/2009 Zemany
2009/0313693 A1 12/2009 Rogers
2009/0322510 A1 12/2009 Berger et al.
2010/0008274 A1 1/2010 Kneckt et al.
2010/0023865 A1 1/2010 Fulker et al.
2010/0026487 A1 2/2010 Hershkovitz
2010/0026802 A1* 2/2010 Titus G08B 13/19608 348/143
2010/0030578 A1 2/2010 Siddique et al.
2010/0030810 A1 2/2010 Marr
2010/0052612 A1 3/2010 Raji et al.
2010/0066530 A1 3/2010 Cohn et al.
2010/0074112 A1 3/2010 Derr et al.
2010/0077111 A1 3/2010 Holmes et al.
2010/0082744 A1 4/2010 Raji et al.
2010/0095111 A1 4/2010 Gutt et al.
2010/0095369 A1 4/2010 Gutt et al.
2010/0121521 A1 5/2010 Kiribayashi
2010/0153853 A1 6/2010 Dawes et al.
2010/0159967 A1 6/2010 Pounds et al.
2010/0185857 A1 7/2010 Neitzel et al.
2010/0197219 A1 8/2010 Issa et al.
2010/0210240 A1 8/2010 Mahaffey et al.
2010/0212012 A1 8/2010 Touboul et al.
2010/0218104 A1 8/2010 Lewis
2010/0245107 A1 9/2010 Fulker et al.
2010/0267390 A1 10/2010 Lin et al.
2010/0280635 A1 11/2010 Cohn et al.
2010/0280637 A1* 11/2010 Cohn G08B 29/02 700/90
2010/0298024 A1 11/2010 Choi
2010/0321151 A1 12/2010 Matsuura et al.
2010/0332164 A1 12/2010 Aisa et al.
2011/0000521 A1 1/2011 Tachibana
2011/0029875 A1 2/2011 Milch
2011/0040415 A1 2/2011 Nickerson et al.
2011/0040877 A1 2/2011 Foisy
2011/0087988 A1* 4/2011 Ray G06Q 10/06 715/771
2011/0096678 A1 4/2011 Ketonen
2011/0102588 A1 5/2011 Trundle et al.
2011/0197327 A1 8/2011 McElroy et al.
2011/0234392 A1 9/2011 Cohn et al.
2011/0283006 A1 11/2011 Ramamurthy
2011/0286437 A1* 11/2011 Austin H04W 4/02 370/338
2012/0023151 A1 1/2012 Bennett, III et al.
2012/0066608 A1 3/2012 Sundermeyer et al.
2012/0081842 A1 4/2012 Ewing et al.
2012/0150966 A1 6/2012 Fan
2012/0154138 A1 6/2012 Cohn et al.
2012/0182245 A1 7/2012 Hutton
2012/0242788 A1 9/2012 Chuang et al.
2012/0260184 A1 10/2012 Dawes et al.
2012/0278877 A1 11/2012 Baum et al.
2012/0309354 A1* 12/2012 Du H04W 12/02 455/411
2012/0315848 A1* 12/2012 Smith H04B 5/02 455/41.1
2012/0327242 A1 12/2012 Barley et al.
2013/0120134 A1* 5/2013 Hicks, III G08B 25/004 340/501
2013/0121239 A1* 5/2013 Hicks, III H04W 4/12 370/328
2013/0136102 A1* 5/2013 Macwan H04W 4/00 370/331
2013/0174239 A1* 7/2013 Kim G06F 21/31 726/7
2013/0223279 A1* 8/2013 Tinnakornsrisuphap H04L 41/0809 370/254
2013/0258047 A1* 10/2013 Morimoto G06T 5/006 348/36
2014/0143695 A1 5/2014 Sundermeyer et al.
2014/0143854 A1 5/2014 Lopez et al.
2014/0153695 A1 6/2014 Yanagisawa et al.
2014/0369584 A1* 12/2014 Fan A61B 6/501 382/131
2015/0009325 A1* 1/2015 Kardashov H04N 7/183 348/143
2015/0088982 A1 3/2015 Johnson et al.
2015/0097961 A1 4/2015 Ure et al.
2015/0142991 A1* 5/2015 Zaloom H04L 43/10 709/248

FOREIGN PATENT DOCUMENTS

AU 2011250886 A1 1/2013
AU 2011305163 A1 5/2013
CA 2559842 C 5/2014
EP 0295146 A2 12/1988
EP 0308046 A2 3/1989
EP 0591585 A1 4/1994
EP 0978111 B1 11/2001
EP 2112784 A1 10/2009
FR 2584217 A1 1/1987
FR 2661023 A1 10/1991
FR 2793334 A1 11/2000
GB 2222288 A 2/1990
GB 2273593 A 6/1994
GB 2319373 A 5/1998
GB 2324630 A 10/1998
GB 2335523 A 9/1999
GB 2349293 A 10/2000
GB 2370400 A 6/2002
JP 8227491 A 9/1996
JP 2002055895 A 2/2002
JP 2003085258 A 3/2003
JP 2003141659 A 5/2003
JP 2004192659 A 7/2004
KR 20060021605 A 3/2006
WO WO-8907855 A1 8/1989
WO WO-9403881 A1 2/1994
WO WO-9636301 A1 11/1996
WO WO-9849663 A1 11/1998
WO WO-9934339 A2 7/1999
WO WO-0152478 A2 7/2001
WO WO-0199078 A2 12/2001
WO WO-0221300 A1 3/2002
WO WO-02097584 A2 12/2002

(56) **References Cited**

FOREIGN PATENT DOCUMENTS

WO	WO-03040839	A1	5/2003
WO	WO-2004004222	A1	1/2004
WO	WO-2004098127	A1	11/2004
WO	WO-2004107710	A1	12/2004
WO	WO-2005091218	A2	9/2005
WO	WO-2005091218	A3	7/2006
WO	WO-2007038872	A1	4/2007
WO	WO-2007124453	A2	11/2007
WO	WO-2009006670	A1	1/2009
WO	WO-2009145747	A1	12/2009
WO	2011060385		5/2011
WO	WO 2013/051916		4/2013

OTHER PUBLICATIONS

Alarm.com—Interactive Security Systems, Frequently Asked Questions [retrieved on Nov. 4, 2003], 3 pages.
Alarm.com—Interactive Security Systems, Overview [retrieved on Nov. 4, 2003], 2 pages.
Alarm.com—Interactive Security Systems, Product Advantages [retrieved on Nov. 4, 2003], 3 pages.
Australian Patent App. No. 2010297957.
Australian Patent App. No. 2011250886.
Australian Patent App. No. 2011305163.
Canadian Patent App. No. 2559842.
Chinese Patent App. No. 201080053845.7.
Chinese Patent App. No. 201180034090.0.
Control Panel Standard—Features for False Alarm Reduction, The Security Industry Association, SIA 2009, pp. 1-48.
Co-pending U.S. Appl. No. 11/761,745, filed Jun. 12, 2007.
Co-pending U.S. Appl. No. 12/019,568, filed Jan. 24, 2008.
Co-pending U.S. Appl. No. 12/189,780, filed Aug. 11, 2008.
Co-pending U.S. Appl. No. 12/189,785, filed Aug. 11, 2008.
Co-pending U.S. Appl. No. 12/197,931, filed Aug. 25, 2008.
Co-pending U.S. Appl. No. 12/197,946, filed Aug. 25, 2008.
Co-pending U.S. Appl. No. 12/197,958, filed Aug. 25, 2008.
Co-pending U.S. Appl. No. 12/198,039, filed Aug. 25, 2008.
Co-pending U.S. Appl. No. 12/198,051, filed Aug. 25, 2008.
Co-pending U.S. Appl. No. 12/198,060, filed May 28, 2008.
Co-pending U.S. Appl. No. 12/198,066, filed Aug. 25, 2008.
Co-pending U.S. Appl. No. 12/269,735, filed Nov. 12, 2008.
Co-pending U.S. Appl. No. 12/539,537, filed Aug. 11, 2009.
Co-pending U.S. Appl. No. 12/568,718, filed Sep. 29, 2009.
Co-pending U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Co-pending U.S. Appl. No. 12/691,992, filed Jan. 22, 2010.
Co-pending U.S. Appl. No. 12/718,385, filed Mar. 5, 2010.
Co-pending U.S. Appl. No. 12/732,879, filed Mar. 26, 2010.
Co-pending U.S. Appl. No. 12/750,470, filed Mar. 30, 2010.
Co-pending U.S. Appl. No. 12/770,253, filed Apr. 29, 2010.
Co-pending U.S. Appl. No. 12/770,365, filed Apr. 29, 2010.
Co-pending U.S. Appl. No. 12/771,071, filed Apr. 30, 2010.
Co-pending U.S. Appl. No. 12/771,372, filed Apr. 30, 2010.
Co-pending U.S. Appl. No. 12/771,471, filed Apr. 30, 2010.
Co-pending U.S. Appl. No. 12/771,624, filed Apr. 30, 2010.
Co-pending U.S. Appl. No. 12/892,303, filed Sep. 28, 2010.
Co-pending U.S. Appl. No. 12/892,801, filed Sep. 28, 2010.
Co-pending U.S. Appl. No. 12/952,080, filed Nov. 22, 2010.
Co-pending U.S. Appl. No. 12/970,313, filed Dec. 16, 2010.
Co-pending U.S. Appl. No. 12/971,282, filed Dec. 17, 2010.
Co-pending U.S. Appl. No. 12/972,740, filed Dec. 20, 2010.
Co-pending U.S. Appl. No. 13/099,293, filed May 2, 2011.
Co-pending U.S. Appl. No. 13/104,932, filed May 10, 2011.
Co-pending U.S. Appl. No. 13/104,936, filed May 10, 2011.
Co-pending U.S. Appl. No. 13/153,807, filed Jun. 6, 2011.
Co-pending U.S. Appl. No. 13/244,008, filed Sep. 23, 2011.
Co-pending U.S. Appl. No. 13/311,365, filed Dec. 5, 2011.
Co-pending U.S. Appl. No. 13/334,998, filed Dec. 22, 2011.
Co-pending U.S. Appl. No. 13/335,279, filed Dec. 22, 2011.
Co-pending U.S. Appl. No. 13/400,477, filed Dec. 22, 2011.
Co-pending U.S. Appl. No. 13/406,264, filed Feb. 27, 2012.
Co-pending U.S. Appl. No. 13/486,276, filed Jun. 1, 2012.
Co-pending U.S. Appl. No. 13/531,757, filed Jun. 25, 2012.
Co-pending U.S. Appl. No. 13/718,851, filed Dec. 18, 2012.
Co-pending U.S. Appl. No. 13/725,607, filed Dec. 21, 2012.
Co-pending U.S. Appl. No. 13/925,181, filed Jun. 24, 2013.
Co-pending U.S. Appl. No. 13/929,568, filed Jun. 27, 2013.
Co-pending U.S. Appl. No. 13/932,816, filed Jul. 1, 2013.
Co-pending U.S. Appl. No. 13/932,837, filed Jul. 1, 2013.
Co-pending U.S. Appl. No. 29/419,628, filed Apr. 30, 2012.
Co-pending U.S. Appl. No. 29/420,377, filed May 8, 2012.
European Patent App. No. 05725743.8.
European Patent App. No. 08797646.0.
European Patent App. No. 08828613.3.
European Patent App. No. 09807196.2.
European Patent App. No. 10819658.5.
European Patent App. No. 11781184.4.
European Patent App. No. 11827671.6.
Examination Report under Section 18(3) re for UK Patent Application No. GB0620362.4, dated Aug. 13, 2007.
Examination Report under Section 18(3) re for UK Patent Application No. GB0724248.0, dated Jun. 4, 2008.
Examination Report under Section 18(3) re for UK Patent Application No. GB0724248.0, dated Jan. 30, 2008.
Examination Report under Section 18(3) re for UK Patent Application No. GB0724760.4, dated Jan. 30, 2008.
Examination Report under Section 18(3) re for UK Patent Application No. GB0800040.8, dated Jan. 30, 2008.
Faultline, "AT&T Targets Video Home Security as Next Broadband Market," The Register, Nov. 2, 2006, 2 pages.
Final Office Action dated Aug. 1, 2011 for U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Final Office Action dated Jun. 1, 2009 for U.S. Appl. No. 11/084,232, filed Mar. 16, 2005.
Final Office Action dated Jun. 5, 2012 for U.S. Appl. No. 12/771,071, filed Apr. 30, 2010.
Final Office Action dated May 9, 2013 for U.S. Appl. No. 12/189,780, filed Aug. 11, 2008.
Final Office Action dated May 9, 2013 for U.S. Appl. No. 12/952,080, filed Nov. 22, 2010.
Final Office Action dated Jan. 10, 2011 for U.S. Appl. No. 12/189,785, filed Aug. 11, 2008.
Final Office Action dated Jun. 10, 2011 for U.S. Appl. No. 11/084,232, filed Mar. 16, 2005.
Final Office Action dated Jul. 12, 2010 for U.S. Appl. No. 12/019,554, filed Jan. 24, 2008.
Final Office Action dated Jan. 13, 2011 for U.S. Appl. No. 12/189,780, filed Aug. 11, 2008.
Final Office Action dated Sep. 14, 2011 for U.S. Appl. No. 12/197,931, filed Aug. 25, 2008.
Final Office Action dated Feb. 16, 2011 for U.S. Appl. No. 12/019,568, filed Jan. 24, 2008.
Final Office Action dated Oct. 17, 2012 for U.S. Appl. No. 12/637,671, filed Dec. 14, 2009.
Final Office Action dated Sep. 17, 2012 for U.S. Appl. No. 12/197,958, filed Aug. 25, 2008.
Final Office Action dated Mar. 21, 2013 for U.S. Appl. No. 12/691,992, filed Jan. 22, 2010.
Final Office Action dated Jul. 23, 2013 for U.S. Appl. No. 13/531,757, filed Jun. 25, 2012.
Final Office Action dated Feb. 26, 2013 for U.S. Appl. No. 12/771,471, filed Apr. 30, 2010.
Final Office Action dated Jun. 29, 2012 for U.S. Appl. No. 12/539,537, filed Aug. 11, 2009.
Final Office Action dated Dec. 31, 2012 for U.S. Appl. No. 12/770,365, filed Apr. 29, 2010.
Final Office Action dated Oct. 31, 2012 for U.S. Appl. No. 12/771,624, filed Apr. 30, 2010.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US05/08766," dated May 23, 2006, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US08/72831," dated Nov. 4, 2008, 2 pages.

(56) **References Cited**

OTHER PUBLICATIONS

Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US08/74246," dated Nov. 14, 2008, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US08/74260," dated Nov. 13, 2008, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US09/53485," dated Oct. 22, 2009, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US09/55559," dated Nov. 12, 2009, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US10/50585," dated Dec. 30, 2010, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US10/57674," dated Mar. 2, 2011, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US11/34858," dated Oct. 3, 2011, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US11/35994," dated Sep. 28, 2011, 2 pages.
Form PCT/ISA/210, "PCT International Search Report for the Application No. PCT/US11/53136," dated Jan. 5, 2012, 2 pages.
Form PCT/ISA/210, "PCT International Search Report of the Application No. PCT/US08/83254," dated Jan. 14, 2009, 2 pages.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration," 1 pg.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US05/08766," dated May 23, 2006, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US08/72831," dated Nov. 4, 2008, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US08/74246" dated Nov. 14, 2008, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US08/74260," dated Nov. 13, 2008, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US09/53485," dated Oct. 22, 2009, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US09/55559," dated Nov. 12, 2009, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US10/50585," dated Dec. 30, 2010, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US10/57674," dated Mar. 2, 2011, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration for the Application No. PCT/US11/35994," dated Sep. 28, 2011, 1 page.
Form PCT/ISA/220, "PCT Notification of Transmittal of the International Search Report and the Written Opinion of the International Searching Authority, or the Declaration of the Application No. PCT/US08/83254," dated Jan. 14, 2009, 1 page.
Form PCT/ISA/237, "PCT Written Opinion ofthe International Searching Authority for the Application No. PCT/US05/08766," dated May 23, 2006, 5 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority," 6 pgs.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US08/72831," dated Nov. 4, 2008, 6 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US08/74246," dated Nov. 14, 2008, 6 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US08/74260," dated Nov. 13, 2008, 6 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US09/53485," dated Oct. 22, 2009, 8 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US09/55559," dated Nov. 12, 2009, 6 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US10/50585," dated Dec. 30, 2010, 7 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US10/57674," dated Mar. 2, 2011, 6 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US11/34858," dated Oct. 3, 2011, 8 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US11/35994," dated Sep. 28, 2011, 11 pages.
Form PCT/ISA/237, "PCT Written Opinion of the International Searching Authority for the Application No. PCT/US11/53136," dated Jan. 5, 2012.
Form PCT/ISA/237, "PCT Written Opinion ofthe International Searching Authority of the Application No. PCT/US08/83254," dated Jan. 14, 2009, 7 pages.
Gutierrez J.A., "On the Use of IEEE 802.15.4 to Enable Wireless Sensor Networks in Building Automation," Personal, Indoor and Mobile Radio Communications (PIMRC), 15th IEEE International Symposium, 2004, vol. 3, pp. 1865-1869.
Indian Patent App. No. 10698/DELNP/2012.
Indian Patent App. No. 3687/DELNP/2012.
International Patent Application No. PCT/US2013/048324.
International Search Report for Application No. PCT/US13/48324, dated Jan. 14, 2014, 2 pages.
International Search Report for Application No. PCT/US2014/050548, dated Mar. 18, 2015, 4 pages.
Lagotek Wireless Home Automation System, May 2006 [retrieved on Aug. 22, 2012].
Non-Final Office Action dated Apr. 4, 2013 for U.S. Appl. No. 12/197,931, filed Aug. 25, 2008.
Non-Final Office Action dated Mar. 4, 2013 for U.S. Appl. No. 13/400,477, filed Feb. 20, 2012.
Non-Final Office Action dated Jan. 5, 2010 for U.S. Appl. No. 12/019,554, filed Jan. 24, 2008.
Non-Final Office Action dated May 5, 2010 for U.S. Appl. No. 12/189,780, filed Aug. 11, 2008.
Non-Final Office Action dated May 5, 2010 for U.S. Appl. No. 12/189,785, filed Aug. 11, 2008.
Non-Final Office Action dated Feb. 7, 2012 for U.S. Appl. No. 12/637,671, filed Dec. 14, 2009.
Non-Final Office Action dated Feb. 7, 2013 for U.S. Appl. No. 12/970,313, filed Dec. 16, 2010.
Non-Final Office Action dated Feb. 8, 2012 for U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Non-Final Office Action dated Apr. 9, 2012 for U.S. Appl. No. 12/771,624, filed Apr. 30, 2010.
Non-Final Office Action dated Dec. 9, 2008 for U.S. Appl. No. 11/084,232, filed Mar. 16, 2005.
Non-Final Office Action dated Aug. 10, 2012 for U.S. Appl. No. 12/77,1471, filed Apr. 30, 2010.
Non-Final Office Action dated Oct. 11, 2012 for U.S. Appl. No. 12/019,568, filed Jan. 24, 2008.
Non-Final Office Action dated Apr. 12, 2012 for U.S. Appl. No. 12/770,365, filed Apr. 29, 2010.

(56) **References Cited**

OTHER PUBLICATIONS

Non-Final Office Action dated Jul. 12, 2012 for U.S. Appl. No. 12/691,992, filed Jan. 22, 2010.
Non-Final Office Action dated Oct. 12, 2012 for U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Non-Final Office Action dated Sep. 12, 2012 for U.S. Appl. No. 12/952,080, filed Nov. 22, 2010.
Non-Final Office Action dated Apr. 13, 2010 for U.S. Appl. No. 11/761,74,5 filed Jun. 12, 2007.
Non-Final Office Action dated Jul. 13, 2010 for U.S. Appl. No. 12/019,568, filed Jan. 24, 2008.
Non-Final Office Action dated Nov. 14, 2012 for U.S. Appl. No. 13/531,757, filed Jun. 25, 2012.
Non-Final Office Action dated Sep. 14, 2010 for U.S. Appl. No. 11/084,232, filed Mar. 16, 2005.
Non-Final Office Action dated Sep. 16, 2011 for U.S. Appl. No. 12/539,537, filed Aug. 11, 2009.
Non-Final Office Action dated Sep. 17, 2012 for U.S. Appl. No. 12/189,780, filed Aug. 11, 2008.
Non-Final Office Action dated Aug. 18, 2011 for U.S. Appl. No. 12/197,958, filed Aug. 25, 2008.
Non-Final Office Action dated Feb. 18, 2011 for U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Non-Final Office Action dated Jan. 18, 2012 for U.S. Appl. No. 12/771,071, filed Apr. 30, 2010.
Non-Final Office Action dated Feb. 21, 2013 for U.S. Appl. No. 12/771,372, filed Apr. 30, 2010.
Non-Final Office Action dated Jul. 21, 2010 for U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Non-Final Office Action dated Dec. 22, 2010 for U.S. Appl. No. 12/197,931, filed Aug. 25, 2008.
Non-Final Office Action dated Jul. 22, 2013 for U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Non-Final Office Action dated May 23, 2013 for U.S. Appl. No. 13/104,932, filed May 10, 2011.
Non-Final Office Action dated May 23, 2013 for U.S. Appl. No. 13/104,936, filed May 10, 2011.
Non-Final Office Action dated Jan. 26, 2012 for U.S. Appl. No. 12/019,568, filed Jan. 24, 2008.
Non-Final Office Action dated Nov. 26, 2010 for U.S. Appl. No. 12/197,958, filed Aug. 25, 2008.
Non-Final Office Action dated Jun. 27, 2013 for U.S. Appl. No. 12/019,568, filed Jan. 24, 2008.
Non-Final Office Action dated Dec. 30, 2009 for U.S. Appl. No. 11/084,232, filed Mar. 16, 2005.
Non-Final Office Action dated May 30, 2008 for U.S. Appl. No. 11/084,232, filed Mar. 16, 2005.
Notice of Allowance dated May 14, 2013 for U.S. Appl. No. 12/637,671, filed Dec. 14, 2009.
Notice of Allowance dated Oct. 25, 2012 for U.S. Appl. No. 11/084,232, filed Mar. 16, 2005.
Requirement for Restriction/Election dated Jan. 22, 2013 for U.S. Appl. No. 13/104,932, filed May 10, 2011.
Requirement for Restriction/Election dated Jan. 22, 2013 for U.S. Appl. No. 13/104,936, filed May 10, 2011.
Requirement for Restriction/Election dated Oct. 24, 2012 for U.S. Appl. No. 12/750,470, filed Mar. 30, 2010.
Security for the Future, Introducing 5804BD—Advanced two-way wireless remote technology, Advertisement, ADEMCO Group, Syosset, NY, circa 1997.
South African Patent App. No. 2013/02668.
Supplemental European Search Report for Application No. EP05725743.8 dated Sep. 14, 2010, 2 pages.
Supplementary European Search Report for Application No. EP10819658, dated Mar. 10, 2015, 2 pages.
Supplementary European Search Report for Application No. EP11827671, dated Mar. 10, 2015, 2 pages.
Supplementary European Search Report for Application No. EP2191351, dated Jun. 23, 2014, 2 pages.
Supplementary Non-Final Office Action dated Oct. 28, 2010 for U.S. Appl. No. 12/630,092, filed Dec. 3, 2009.
Supplementary Partial European Search Report for Application No. EP09807196, dated Nov. 17, 2014, 5 pages.
Taiwanese Patent App. No. 99113848.
Taiwanese Patent App. No. 99113853.
Taiwanese Patent App. No. 99113855.
Taiwanese Patent App. No. 99113856.
Topalis E., et al., "A Generic Network Management Architecture Targeted to Support Home Automation Networks and Home Internet Connectivity, Consumer Electronics, IEEE Transactions," 2000, vol. 46 (1), pp. 44-51.
United Kingdom Patent No. 2428821.
United Kingdom Patent No. 2442628.
United Kingdom Patent No. 2442633.
United Kingdom Patent No. 2442640.
Wireless, Battery-Powered Smoke Detectors, Brochure, SafeNight Technology, Inc. Roanoke, VA, 1995.
WLS906 Photoelectric Smoke Alarm, Data Sheet, DSC Security Products, Ontario, Canada, Jan. 1998.
X10—ActiveHome, Home Automation Made Easy [retrieved on Nov. 4, 2003], 3 pages.
European Office action in European Application No. EP 14833805, dated May 25, 2017, 10 pages.
EP Examination Report in European Application No. 14833805.6, dated Jan. 14, 2019, 5 pages.
Non-Final Office Action issued in U.S. Appl. No. 14/456,449, dated Dec. 13, 2018, 56 pages.
Sheehan, "Dropcam HD is the Ultimate Home Monitoring Webcam Now with HD Video, Night Vision & 2-Way Audio", dated Jul. 20, 2012, pp. 1-12.
Final Office Action in U.S. Appl. No. 14/456,449, dated Jun. 28, 2019, 59 pages.

* cited by examiner

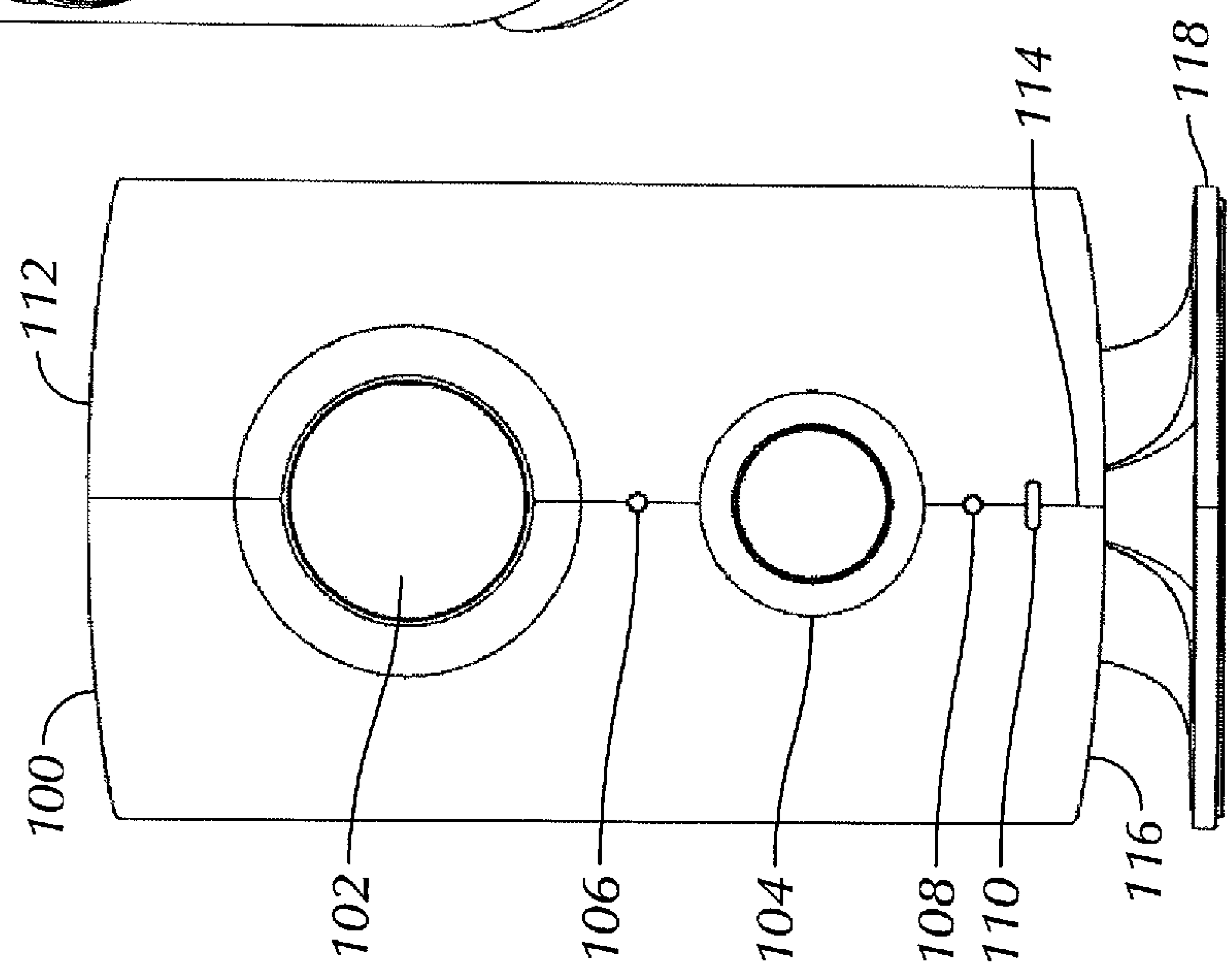


FIG. 1A

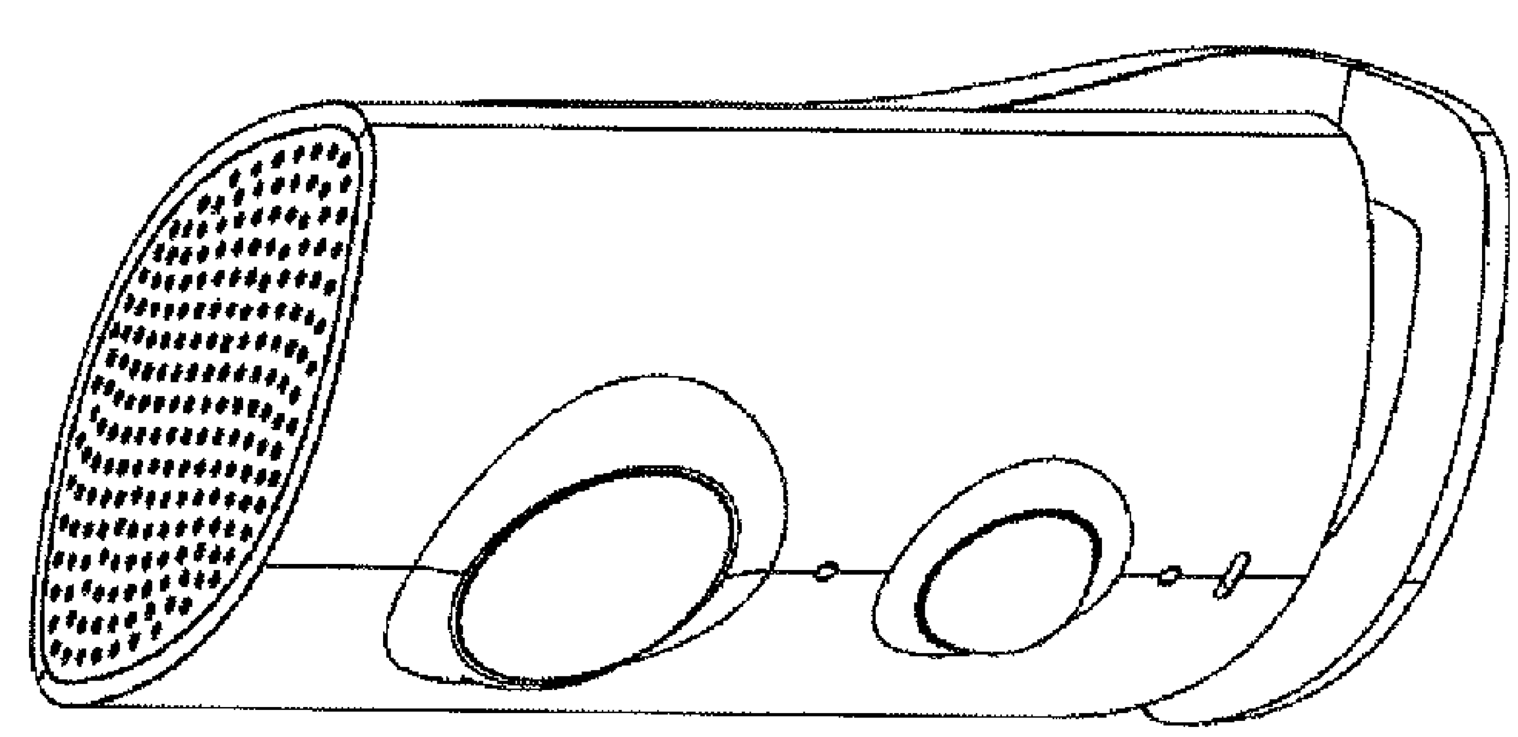


FIG. 1B

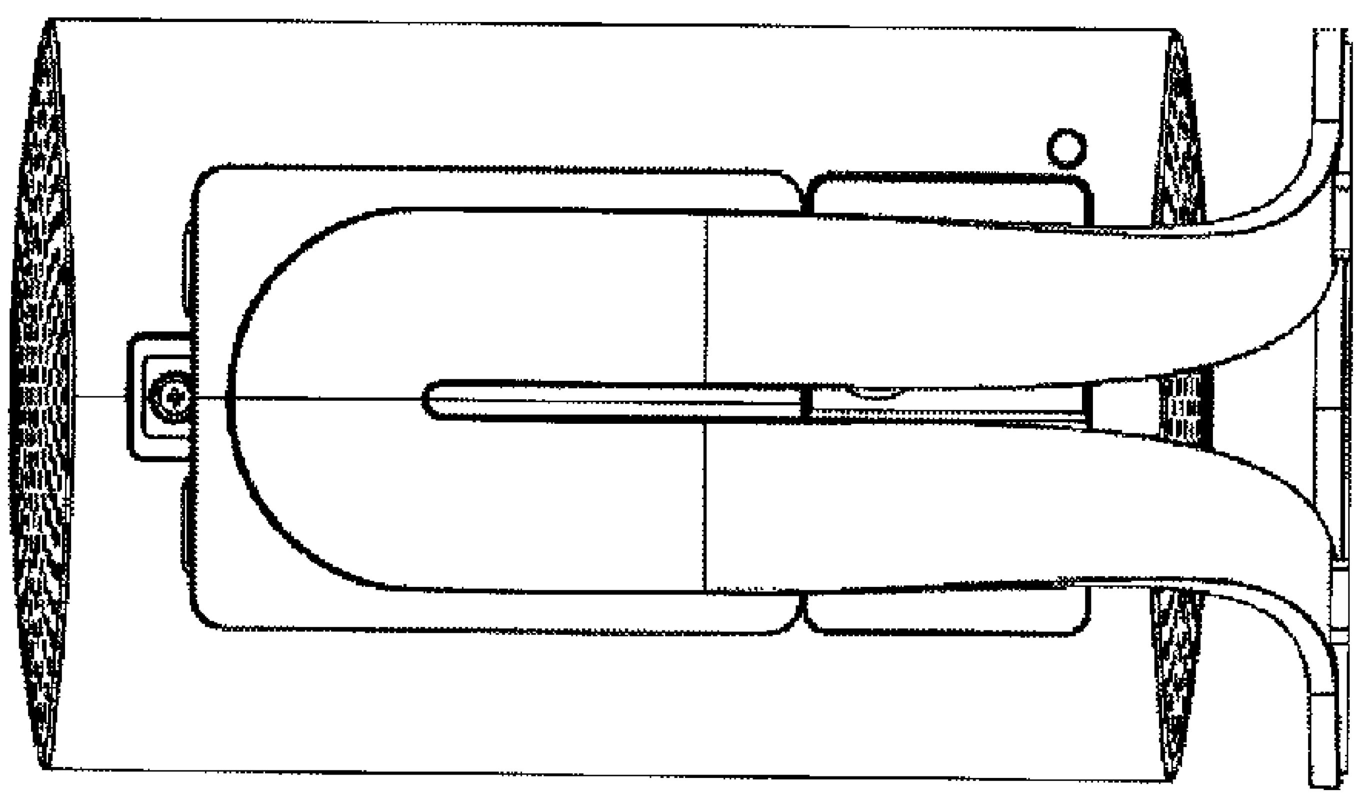


FIG. 1C

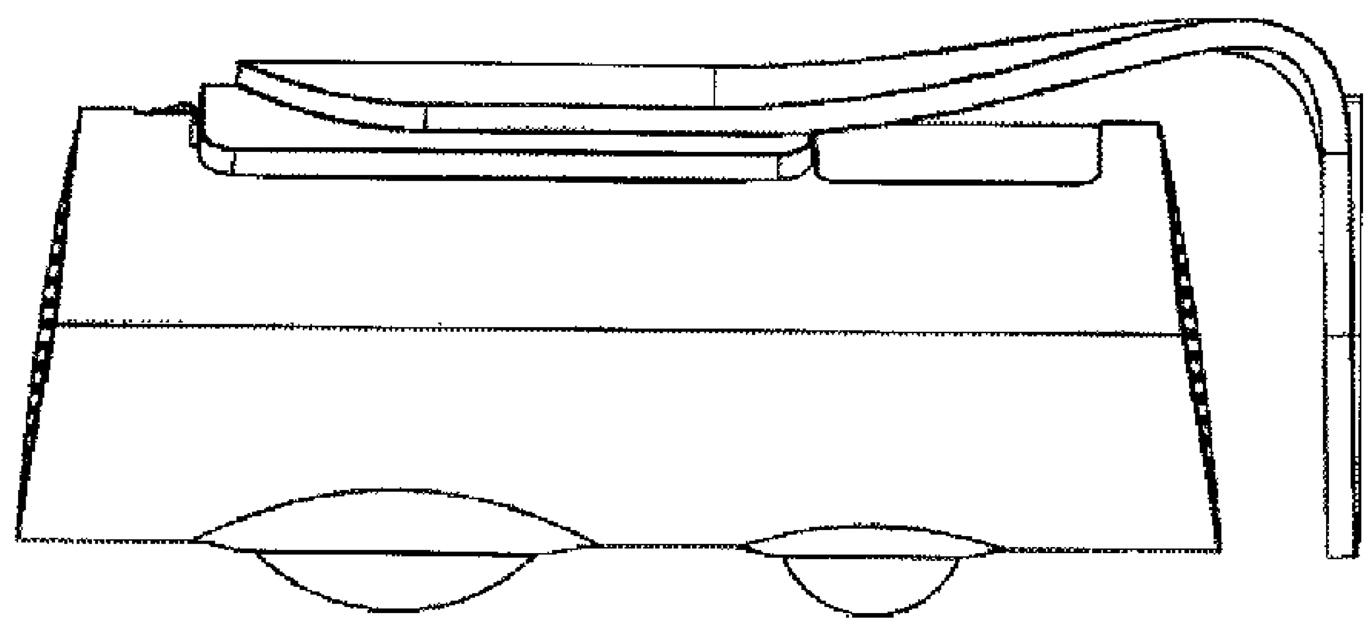


FIG. 1D

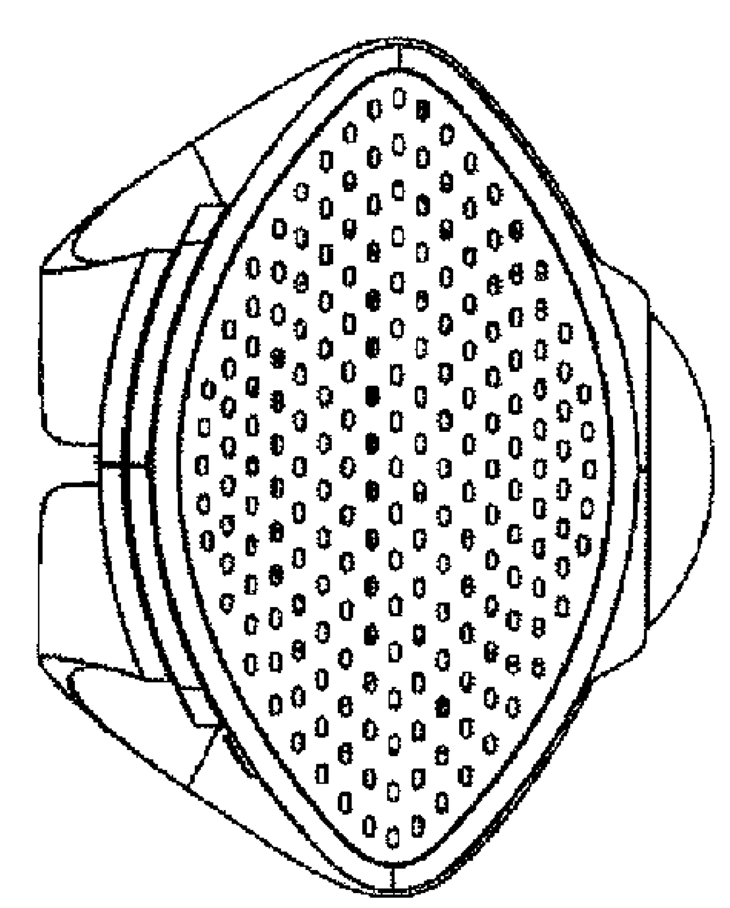


FIG. 1E

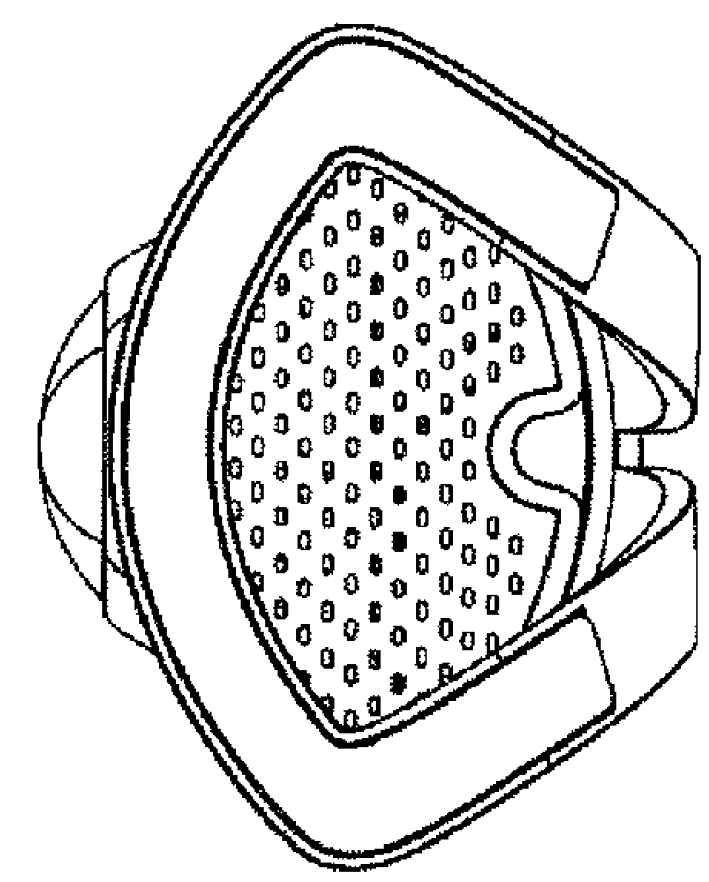


FIG. 1F

200

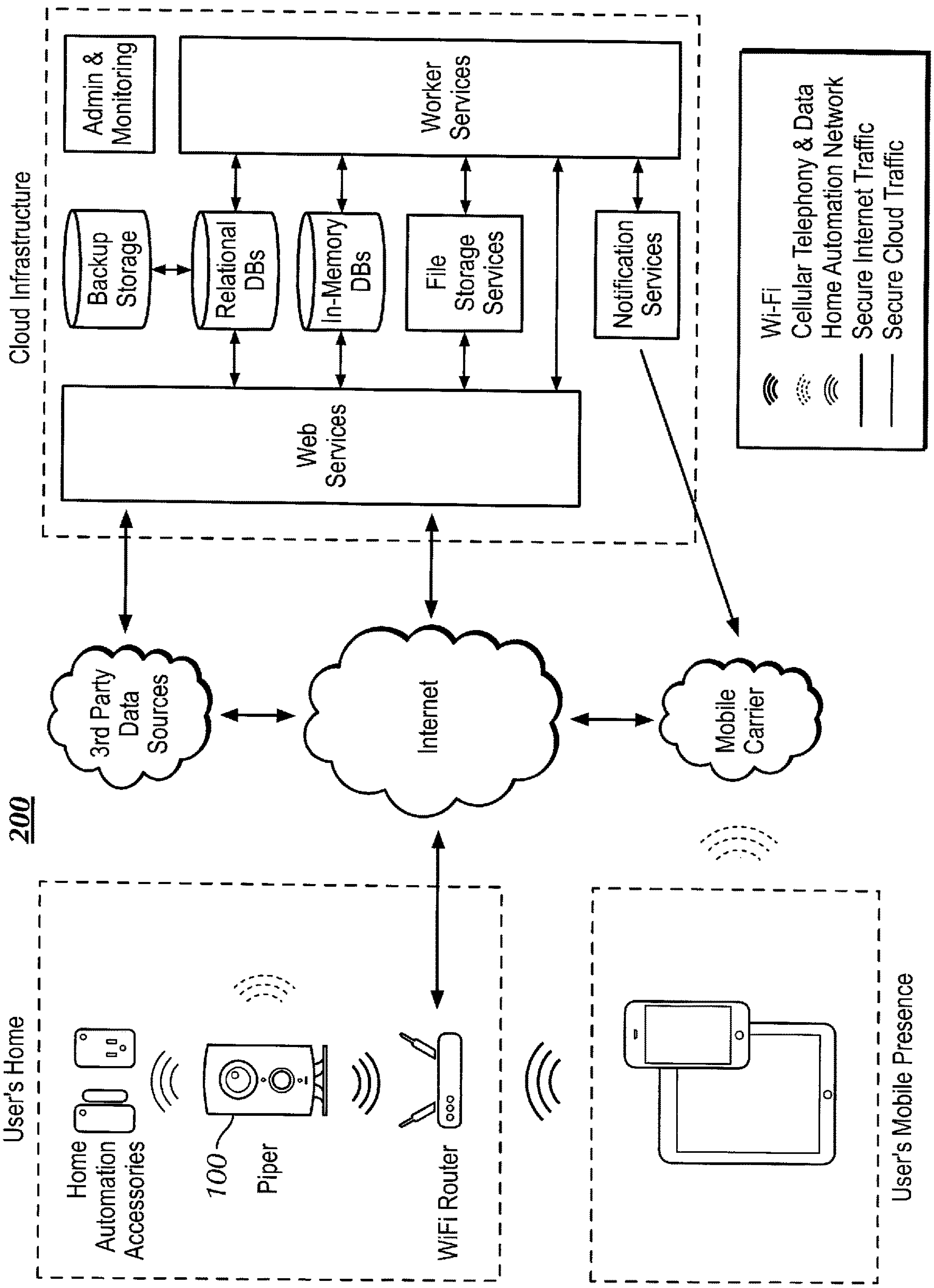
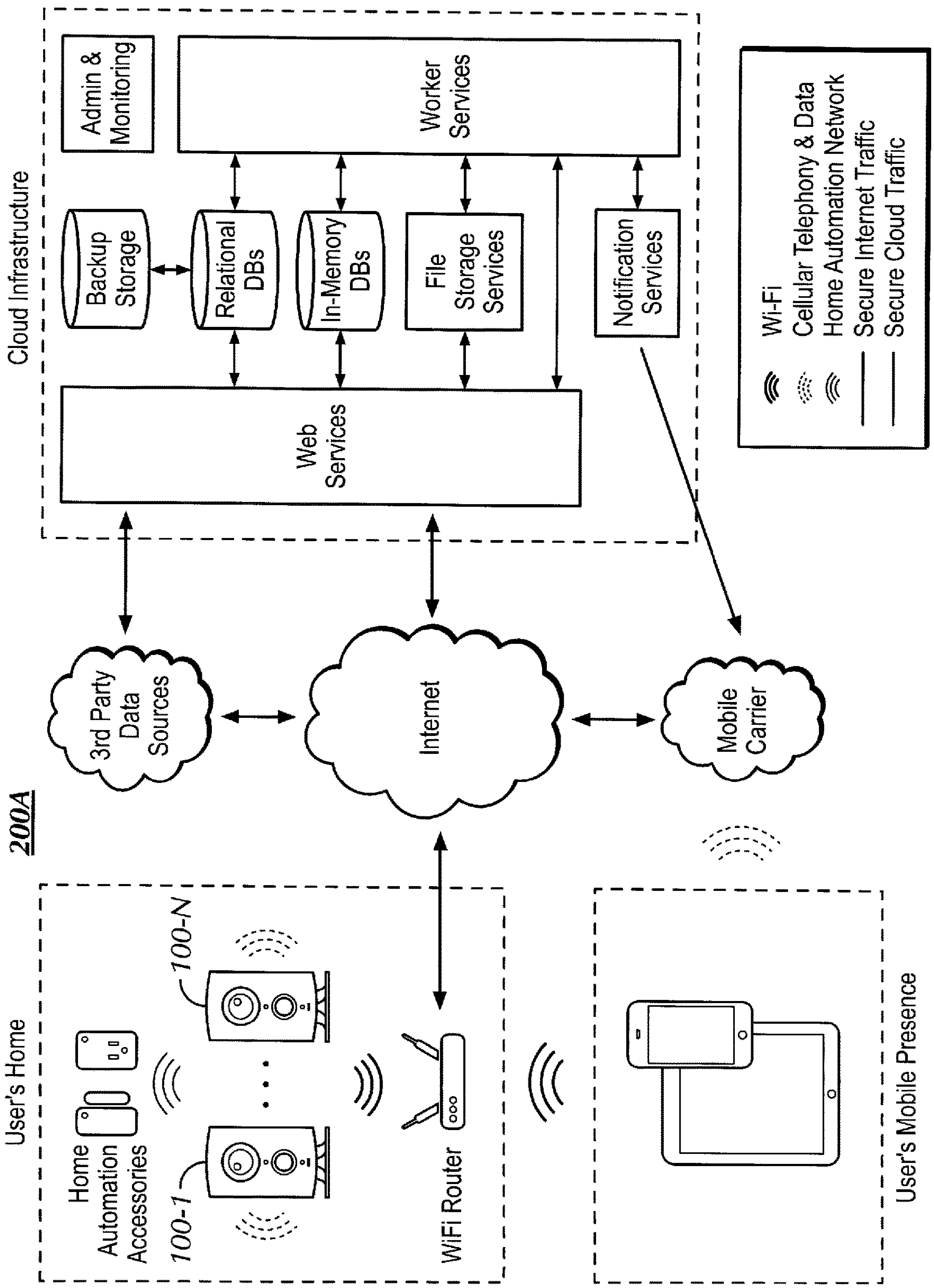

Cloud Infrastructure
Admin & Monitoring
Worker Services
Backup Storage
Relational DBs
In-Memory DBs
File Storage Services
Notification Services
Web Services
Wi-Fi
Cellular Telephony & Data
Home Automation Network
Secure Internet Traffic
Secure Cloud Traffic
3rd Party Data Sources
Internet
Mobile Carrier
User's Home
Home Automation Accessories
100
Piper
WiFi Router
User's Mobile Presence

FIG. 2A


200A
User's Home
Home Automation Accessories
100-1
100-N
WiFi Router
User's Mobile Presence
3rd Party Data Sources
Internet
Mobile Carrier
Cloud Infrastructure
Admin & Monitoring
Worker Services
Backup Storage
Relational DBs
In-Memory DBs
File Storage Services
Notification Services
Web Services
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Home Automation Network
Secure Internet Traffic
Secure Cloud Traffic

FIG. 2B

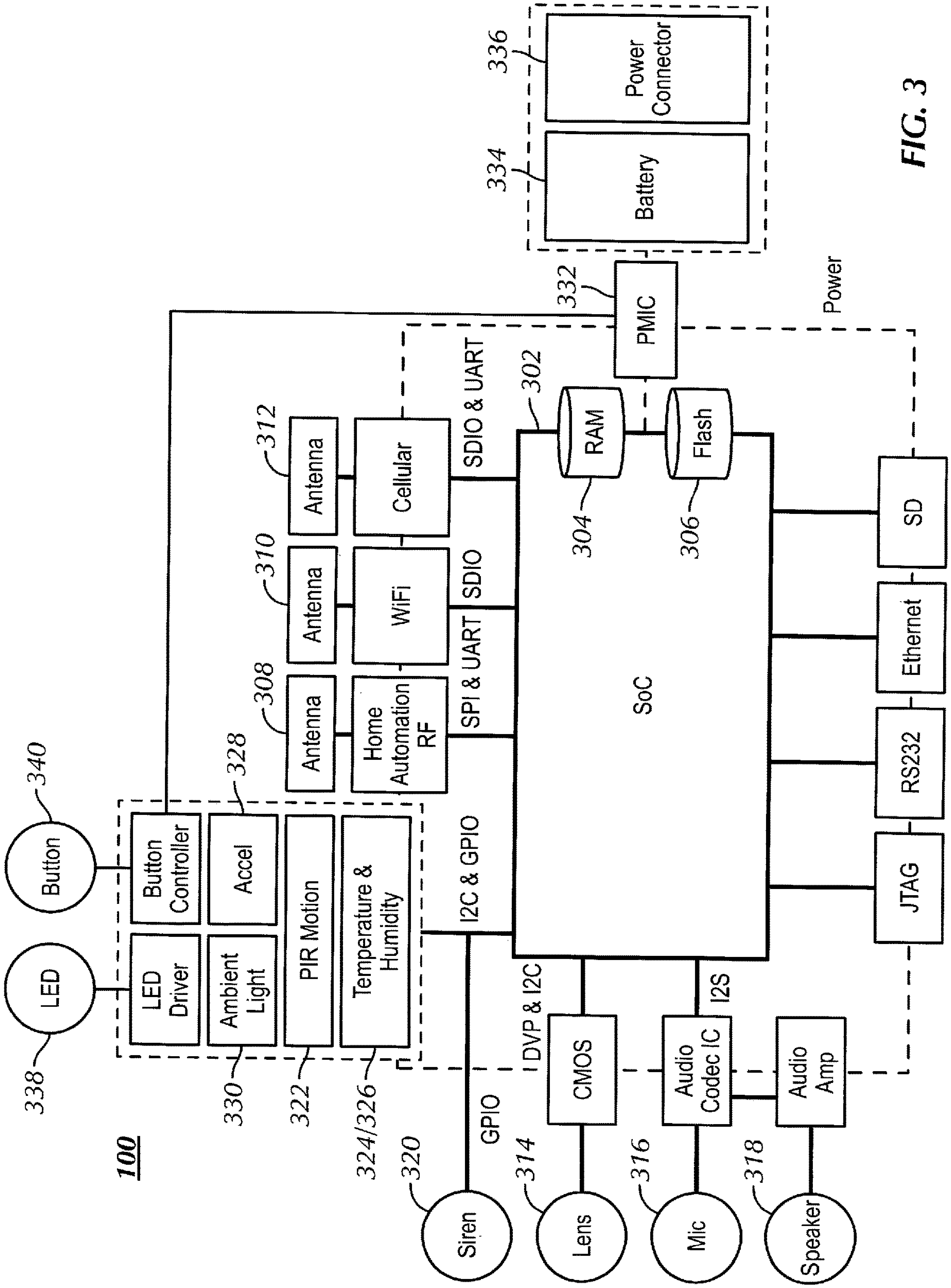
100
Power Connector
Battery
336
334
332
PMIC
Power
302
SDIO & UART
RAM
Flash
304
306
312
310
308
Antenna
Antenna
Antenna
Cellular
WiFi
Home Automation RF
SDIO
SPI & UART
SoC
SD
Ethernet
RS232
JTAG
340
Button
LED
338
Button Controller
Accel
328
LED Driver
Ambient Light
PIR Motion
Temperature & Humidity
330
322
324/326
I2C & GPIO
DVP & I2C
I2S
CMOS
Audio Codec IC
Audio Amp
GPIO
320
314
316
318
Siren
Lens
Mic
Speaker

FIG. 3

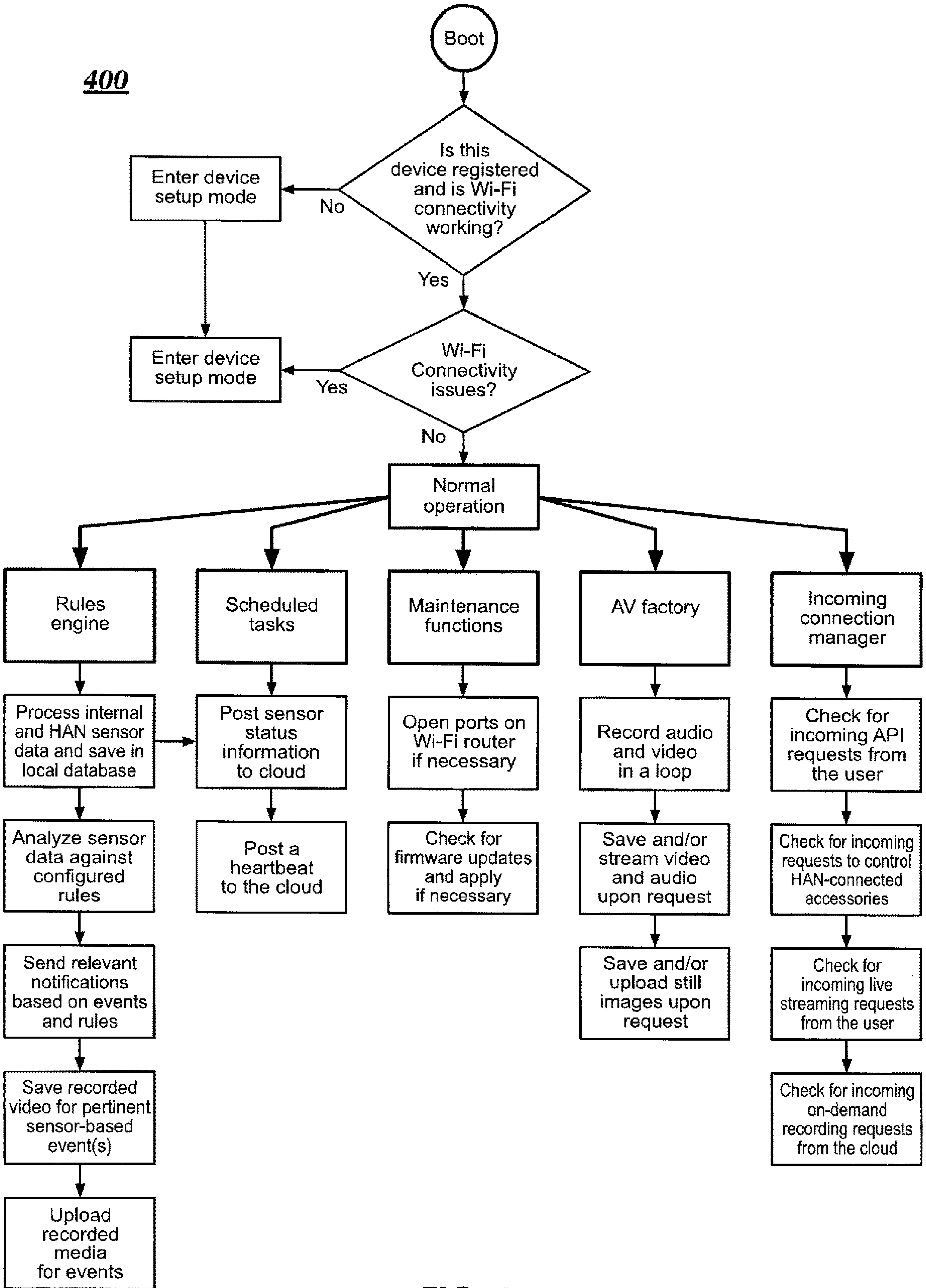
400
Boot
Is this device registered and is Wi-Fi connectivity working?
No
Enter device setup mode
Yes
Wi-Fi Connectivity issues?
Yes
Enter device setup mode
No
Normal operation
Rules engine
Scheduled tasks
Maintenance functions
AV factory
Incoming connection manager
Process internal and HAN sensor data and save in local database
Post sensor status information to cloud
Open ports on Wi-Fi router if necessary
Record audio and video in a loop
Check for incoming API requests from the user
Analyze sensor data against configured rules
Post a heartbeat to the cloud
Check for firmware updates and apply if necessary
Save and/or stream video and audio upon request
Check for incoming requests to control HAN-connected accessories
Send relevant notifications based on events and rules
Save and/or upload still images upon request
Check for incoming live streaming requests from the user
Save recorded video for pertinent sensor-based event(s)
Check for incoming on-demand recording requests from the cloud
Upload recorded media for events

FIG. 4

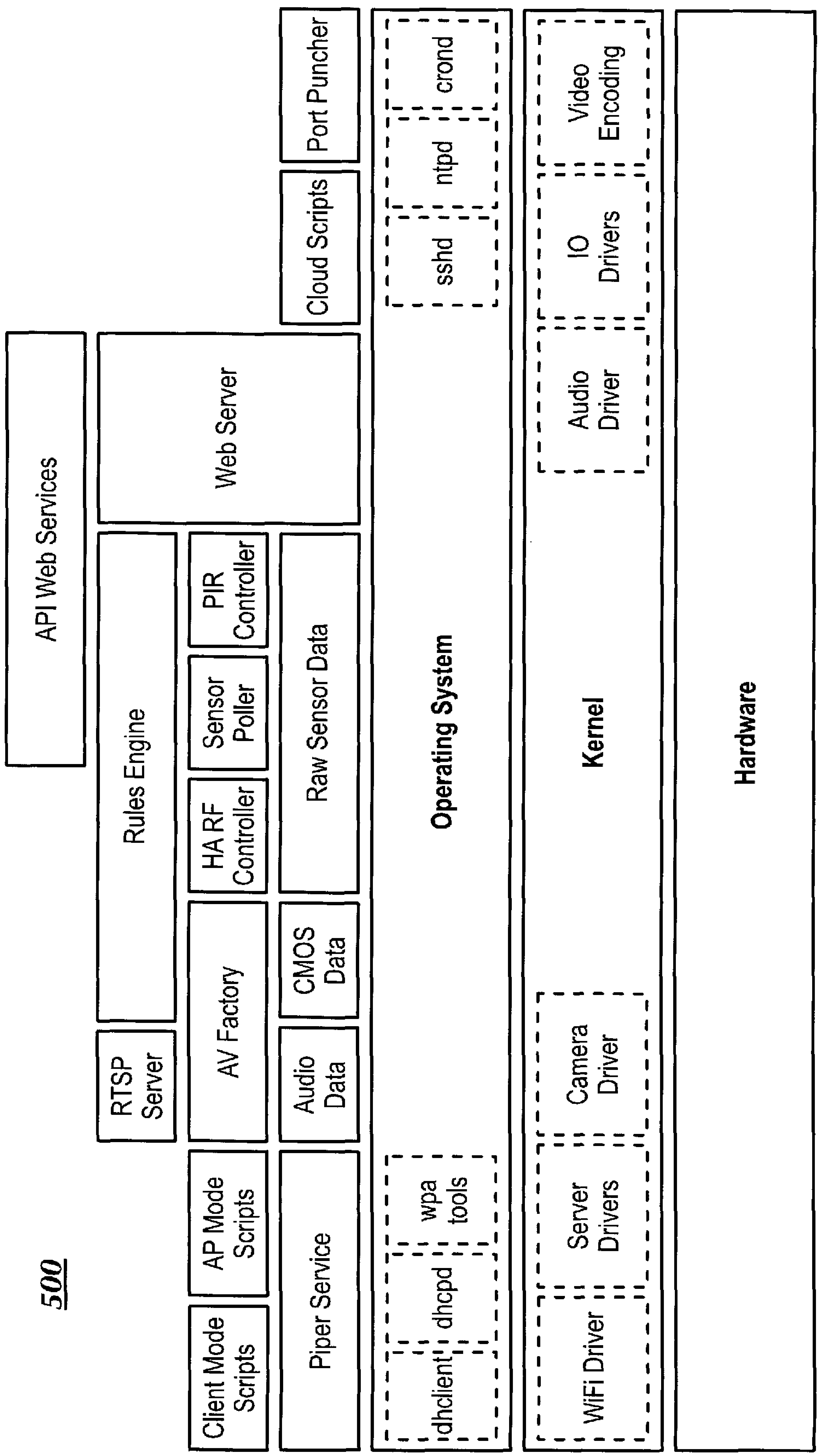
500
API Web Services
RTSP Server
Rules Engine
Web Server
Client Mode Scripts
AP Mode Scripts
AV Factory
HA RF Controller
Sensor Poller
PIR Controller
Piper Service
Audio Data
CMOS Data
Raw Sensor Data
Cloud Scripts
Port Puncher
dhclient
dhcpd
wpa tools
Operating System
sshd
ntpd
crond
WiFi Driver
Server Drivers
Camera Driver
Kernel
Audio Driver
IO Drivers
Video Encoding
Hardware

FIG. 5

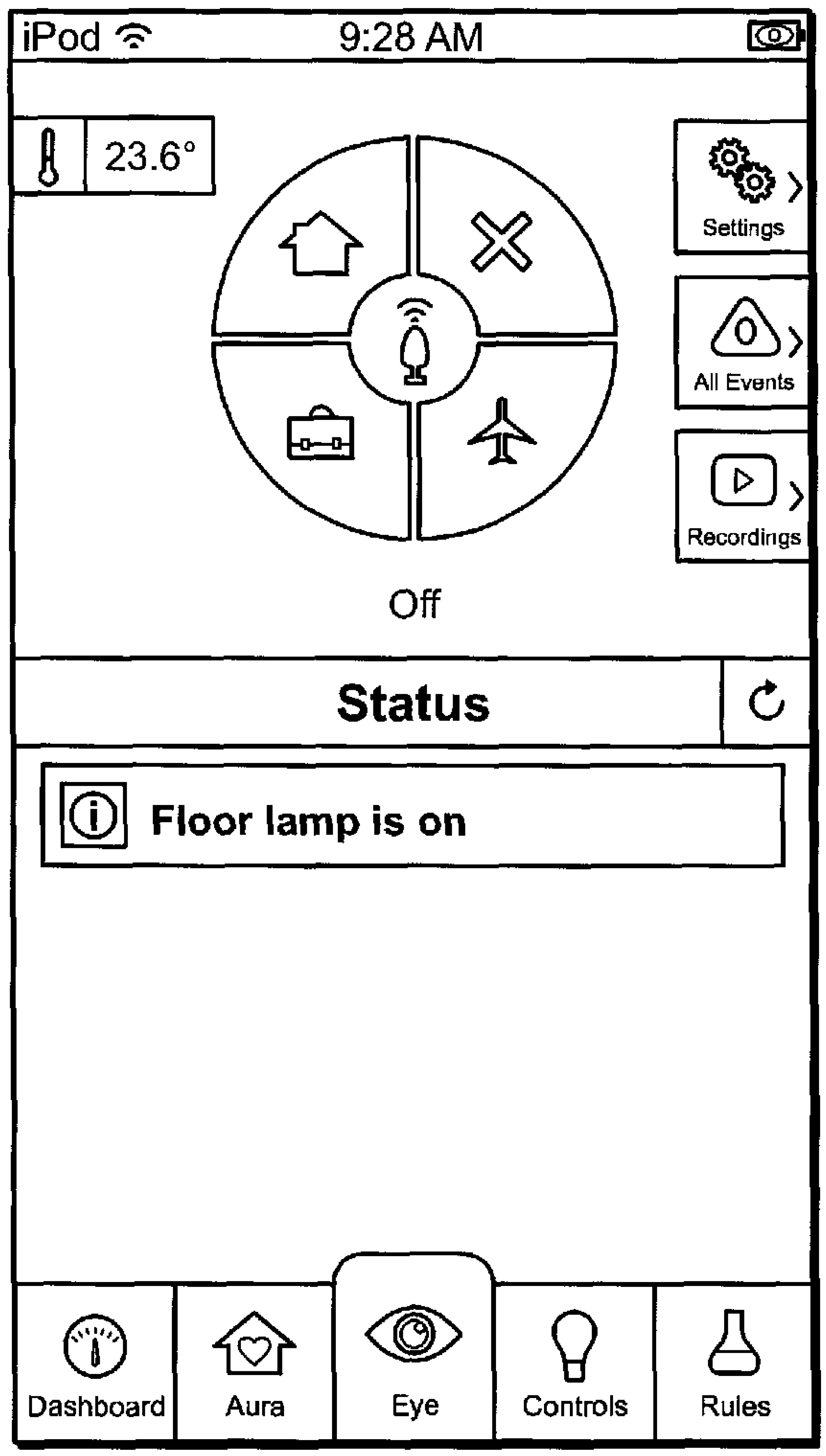
iPod
9:28 AM
23.6°
Settings
All Events
Recordings
Off
Status
Floor lamp is on
Dashboard
Aura
Eye
Controls
Rules

FIG. 6A

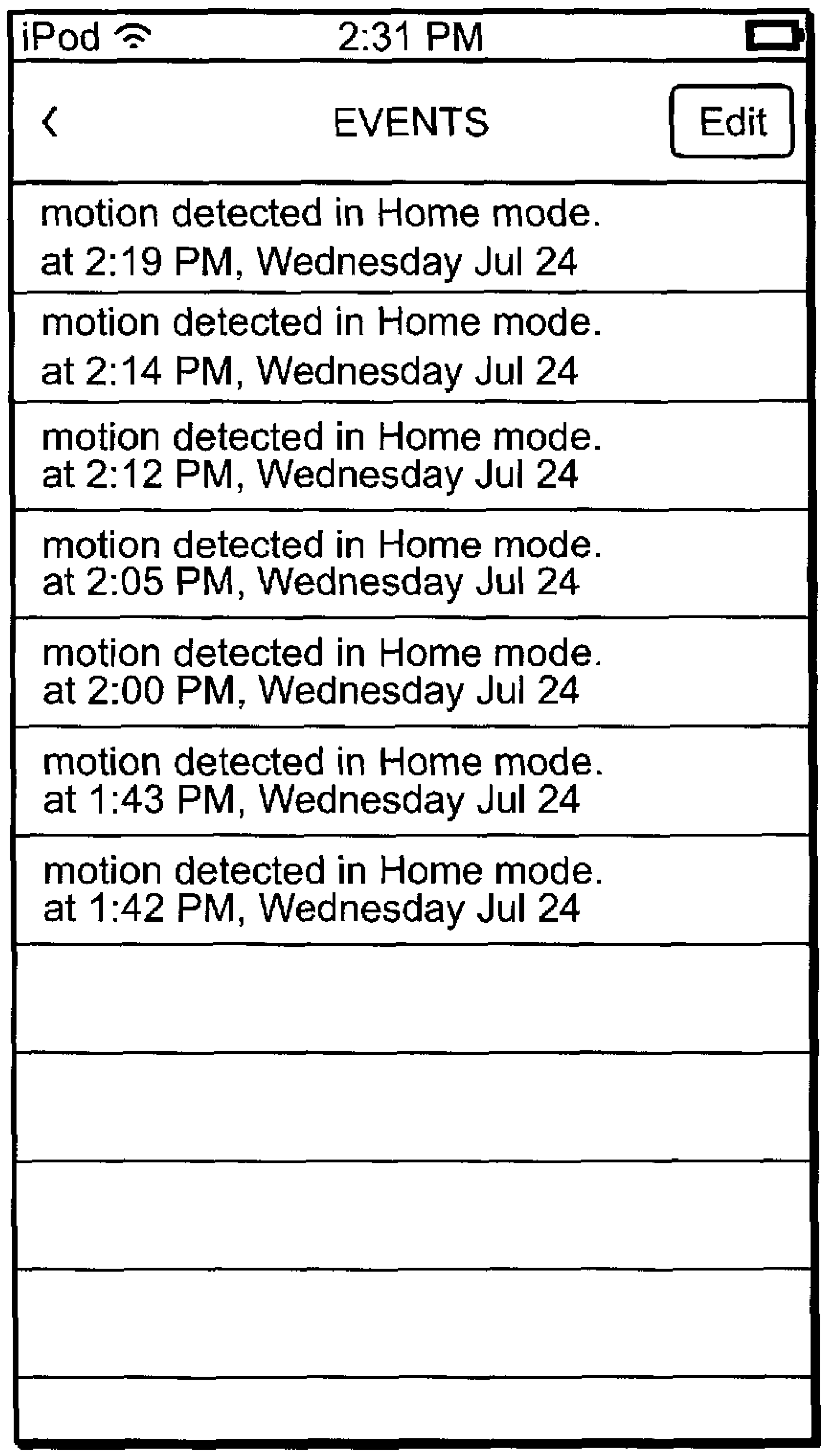
iPod
2:31 PM
EVENTS
Edit
motion detected in Home mode.
at 2:19 PM, Wednesday Jul 24
motion detected in Home mode.
at 2:14 PM, Wednesday Jul 24
motion detected in Home mode.
at 2:12 PM, Wednesday Jul 24
motion detected in Home mode.
at 2:05 PM, Wednesday Jul 24
motion detected in Home mode.
at 2:00 PM, Wednesday Jul 24
motion detected in Home mode.
at 1:43 PM, Wednesday Jul 24
motion detected in Home mode.
at 1:42 PM, Wednesday Jul 24

FIG. 6B

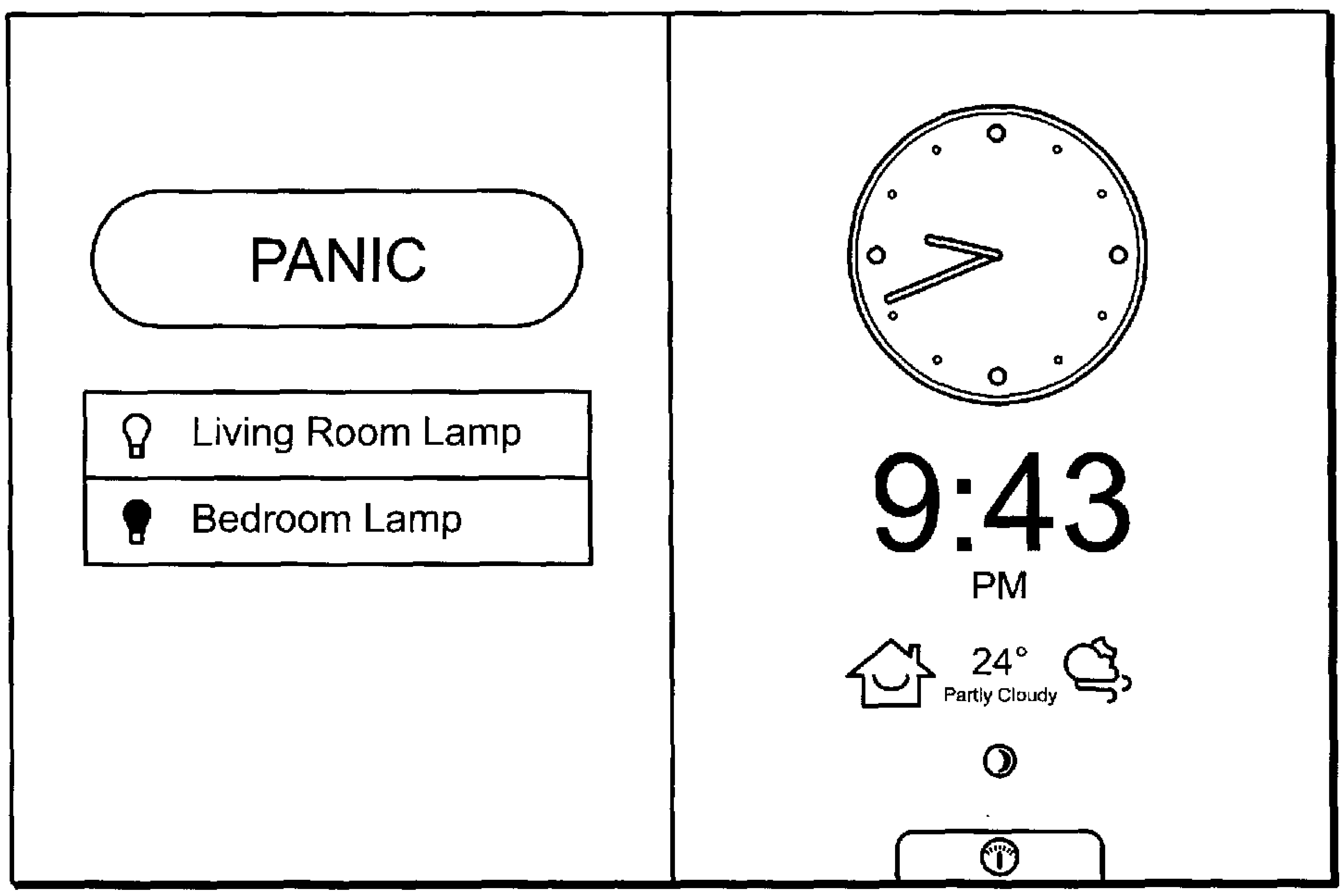

FIG. 7

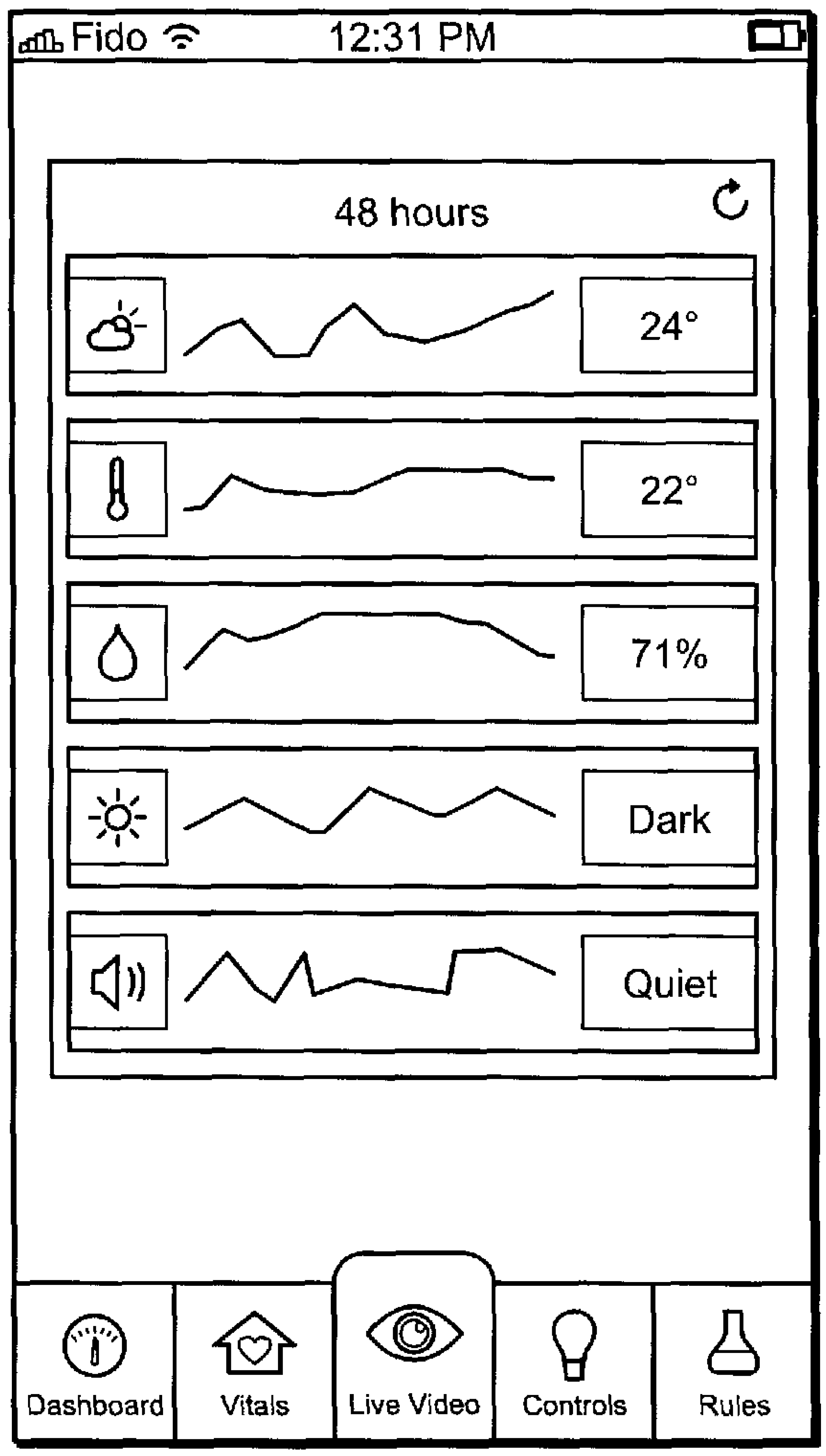
Fido
12:31 PM
48 hours
24°
22°
71%
Dark
Quiet
Dashboard
Vitals
Live Video
Controls
Rules

FIG. 8

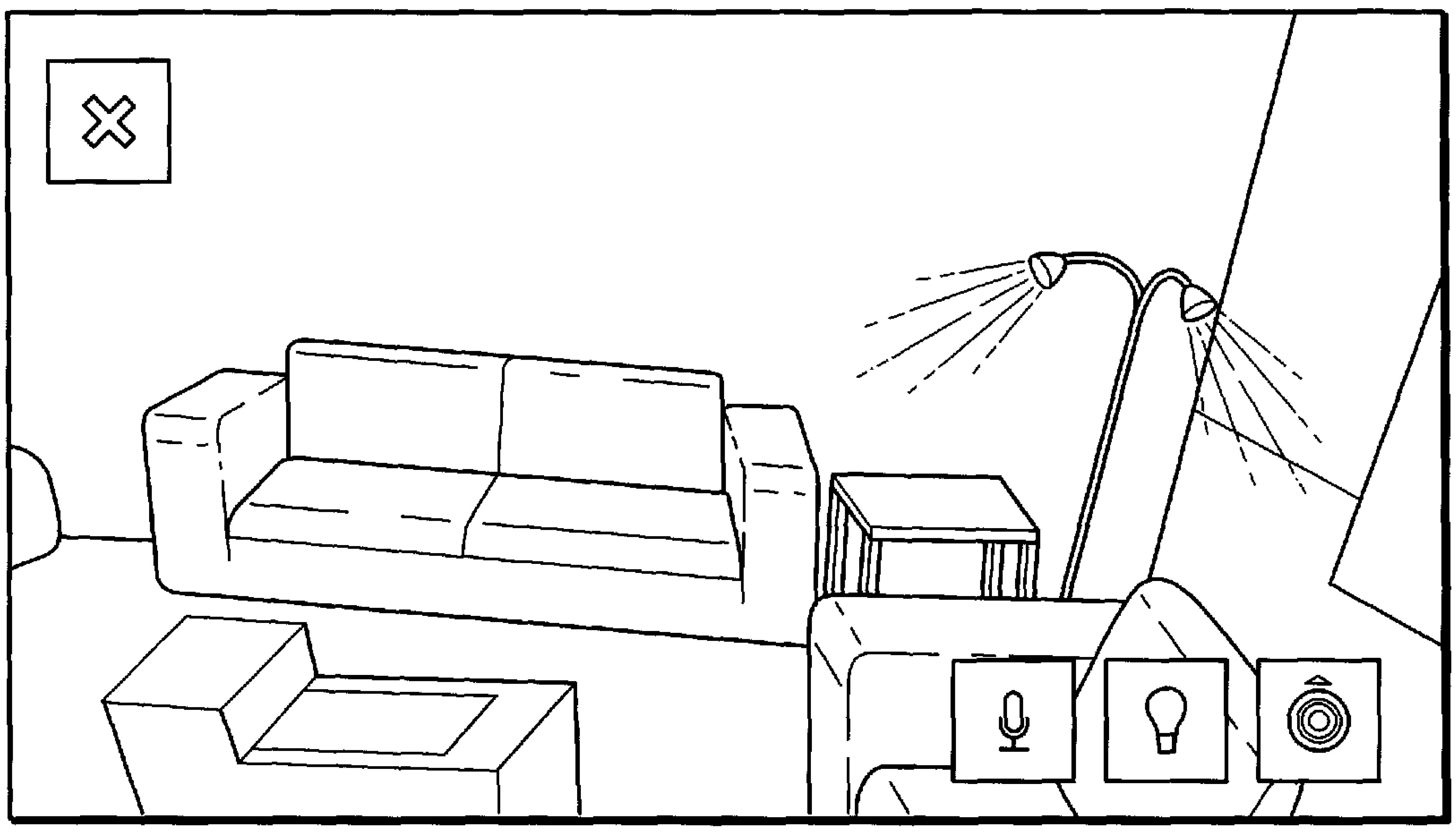

FIG. 9

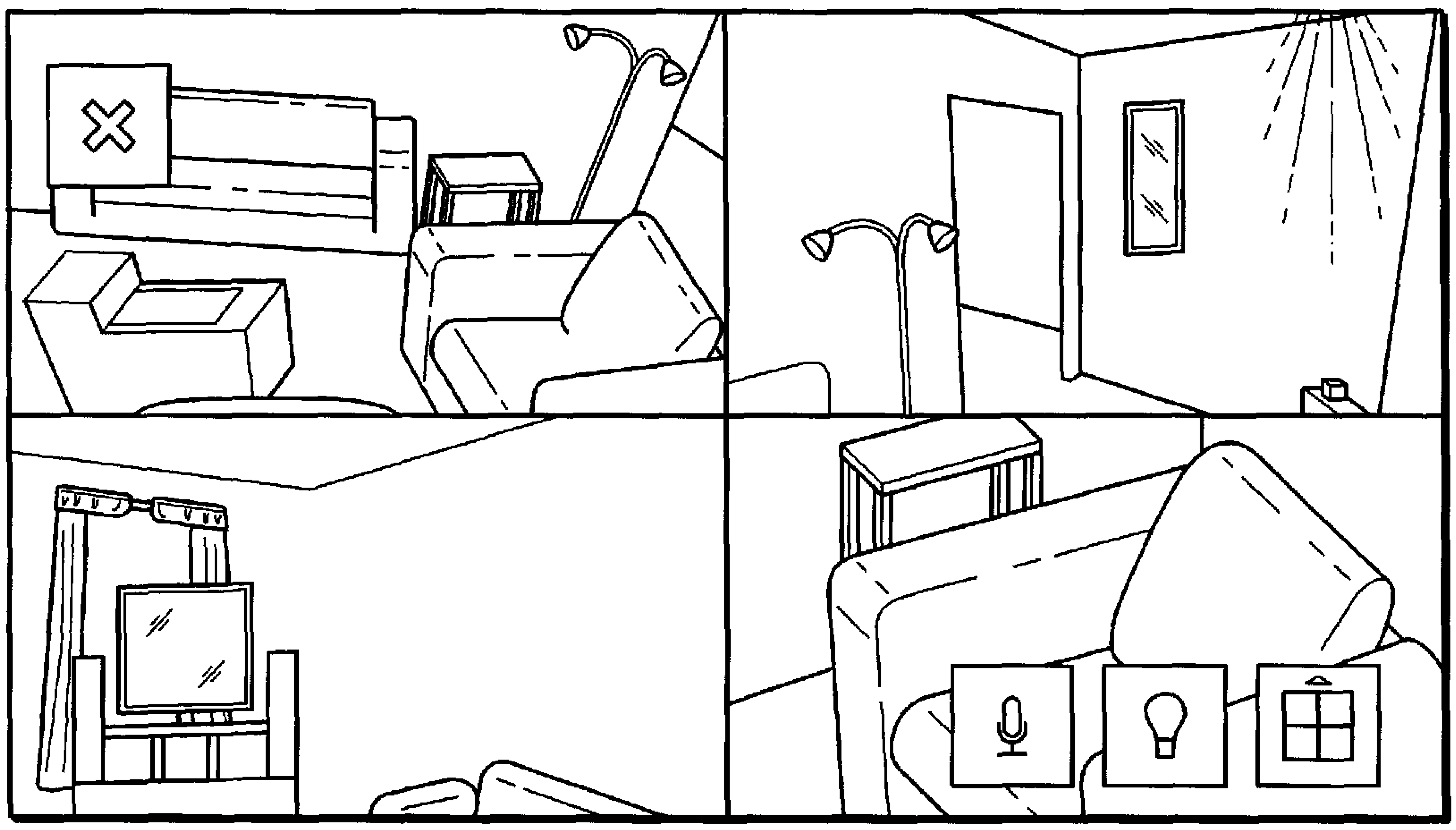

FIG. 10

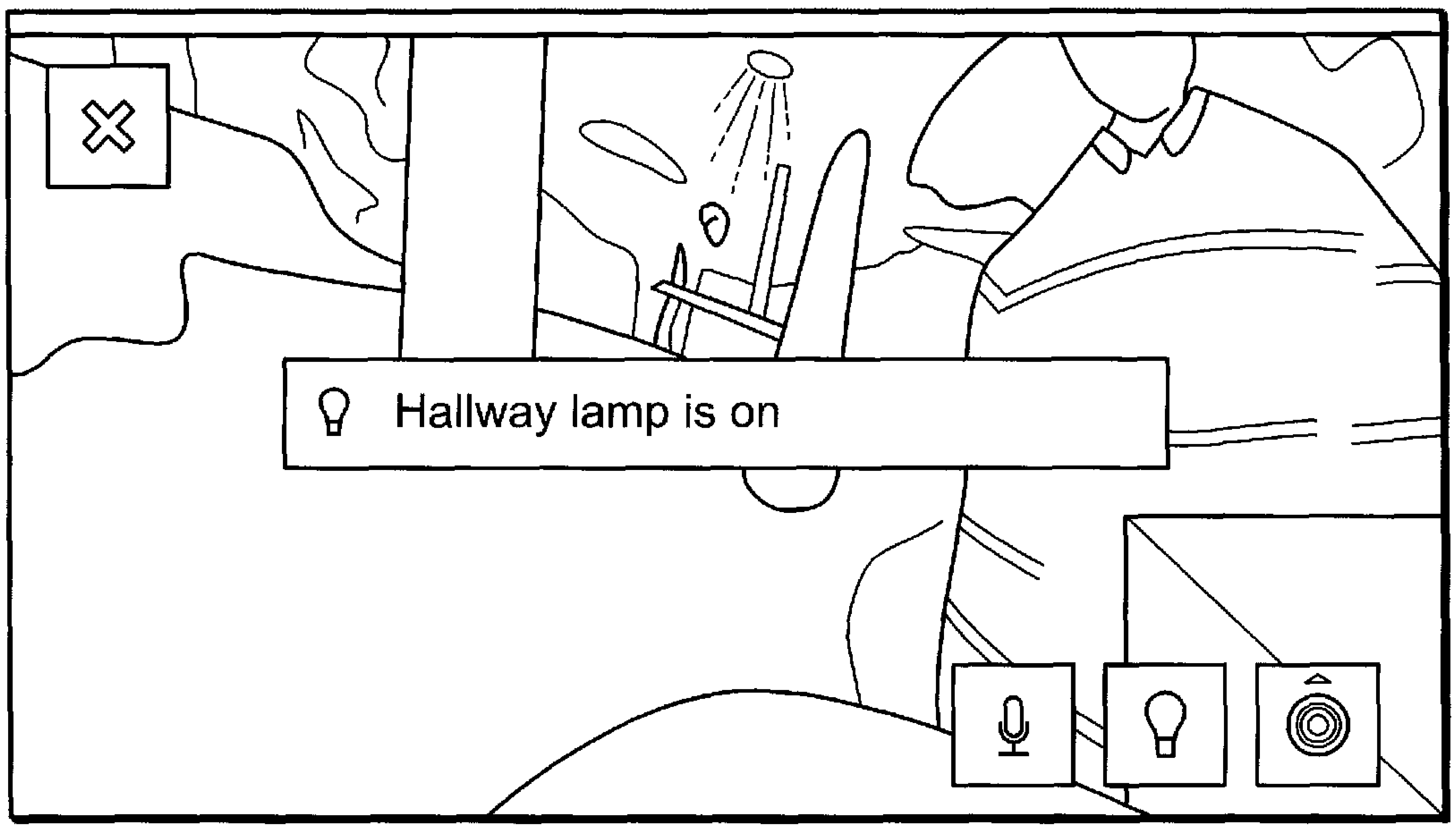

FIG. 11

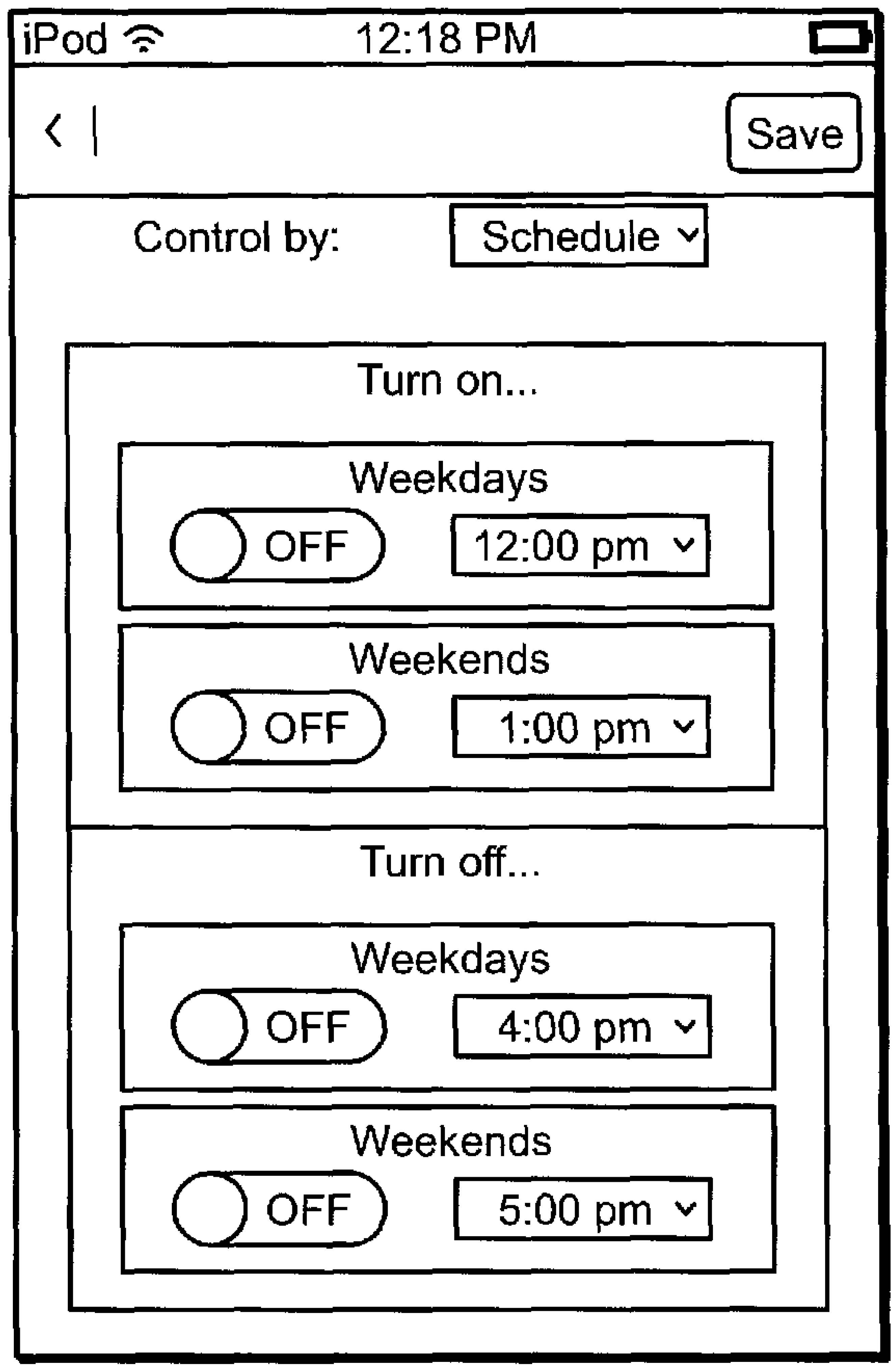
iPod
12:18 PM
Save
Control by:
Schedule
Turn on...
Weekdays
OFF
12:00 pm
Weekends
OFF
1:00 pm
Turn off...
Weekdays
OFF
4:00 pm
Weekends
OFF
5:00 pm

FIG. 12A

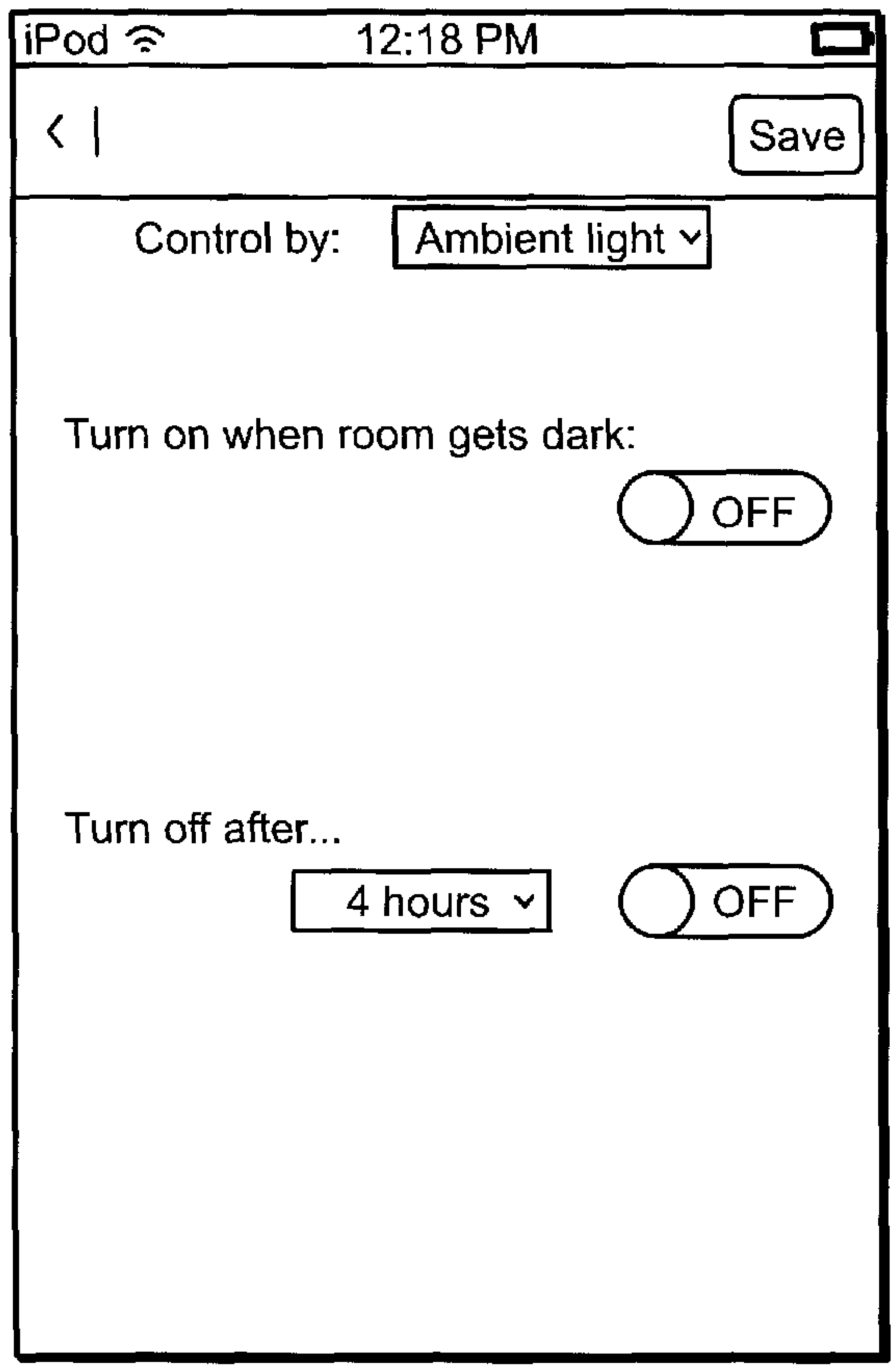
iPod
12:18 PM
Save
Control by:
Ambient light
Turn on when room gets dark:
OFF
Turn off after...
4 hours
OFF

FIG. 12B

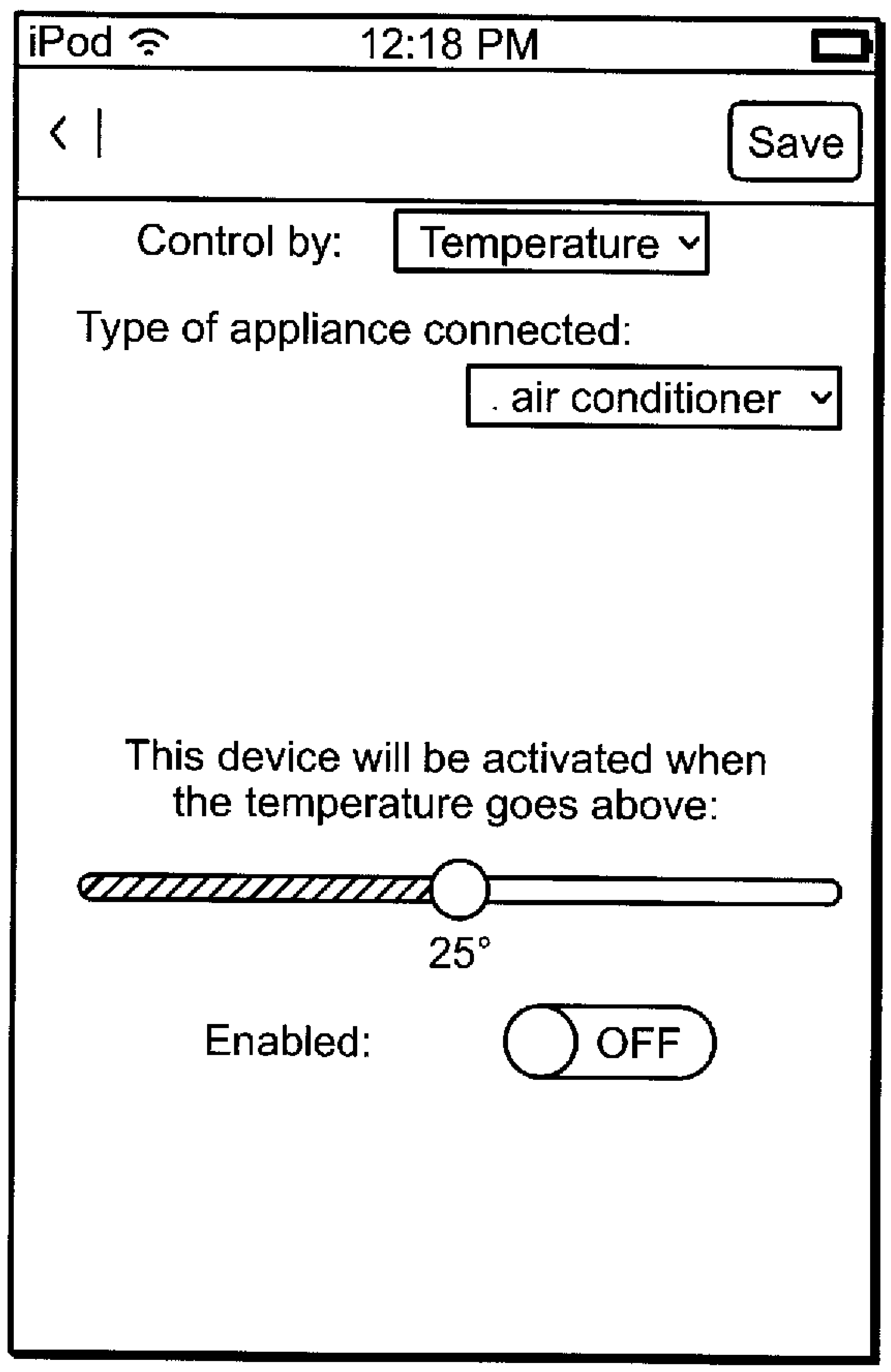
iPod
12:18 PM
Save
Control by:
Temperature
Type of appliance connected:
. air conditioner
This device will be activated when
the temperature goes above:
25°
Enabled:
OFF

FIG. 12C

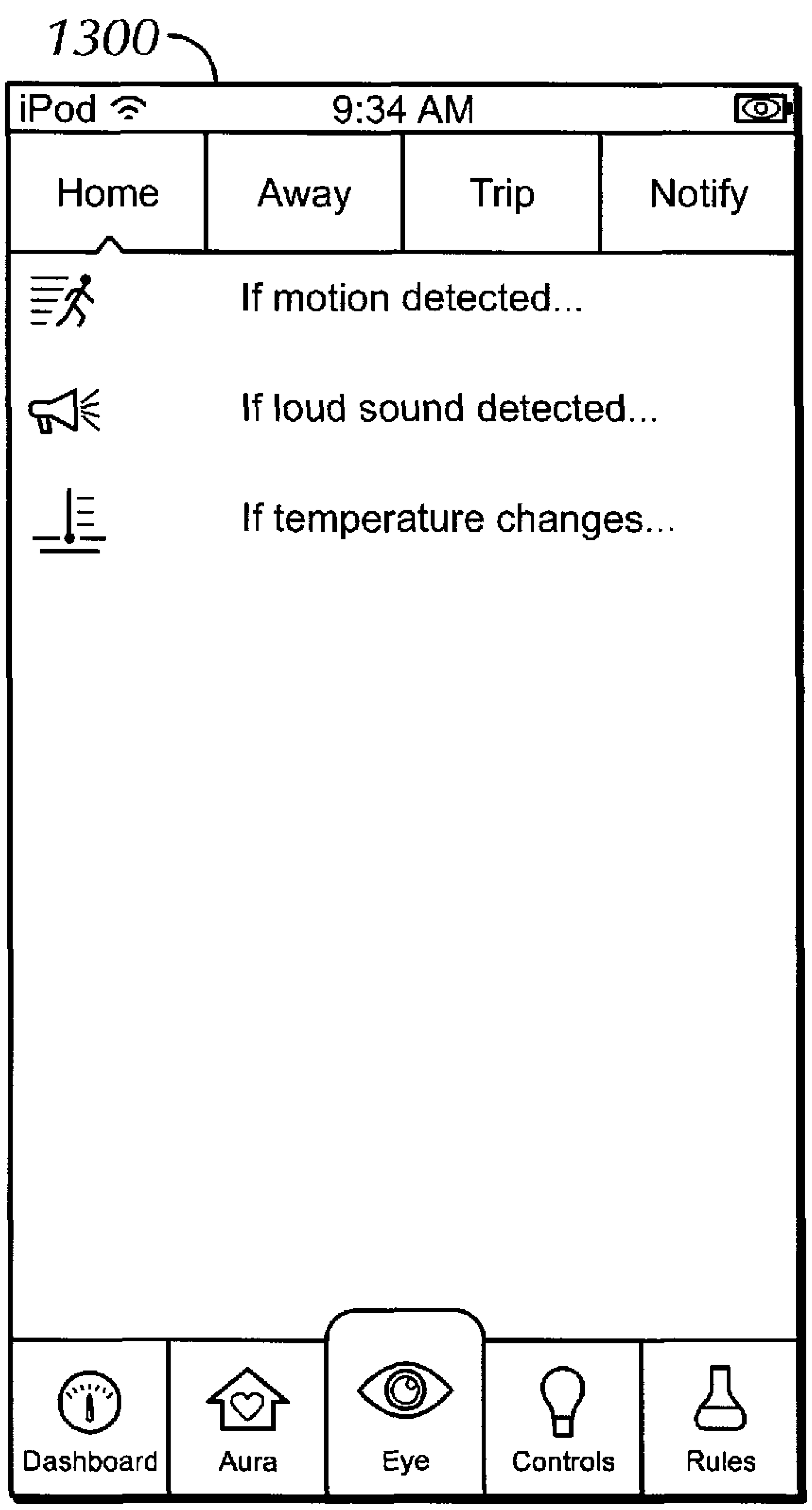
1300
iPod
9:34 AM
Home
Away
Trip
Notify
If motion detected...
If loud sound detected...
If temperature changes...
Dashboard
Aura
Eye
Controls
Rules

FIG. 13A

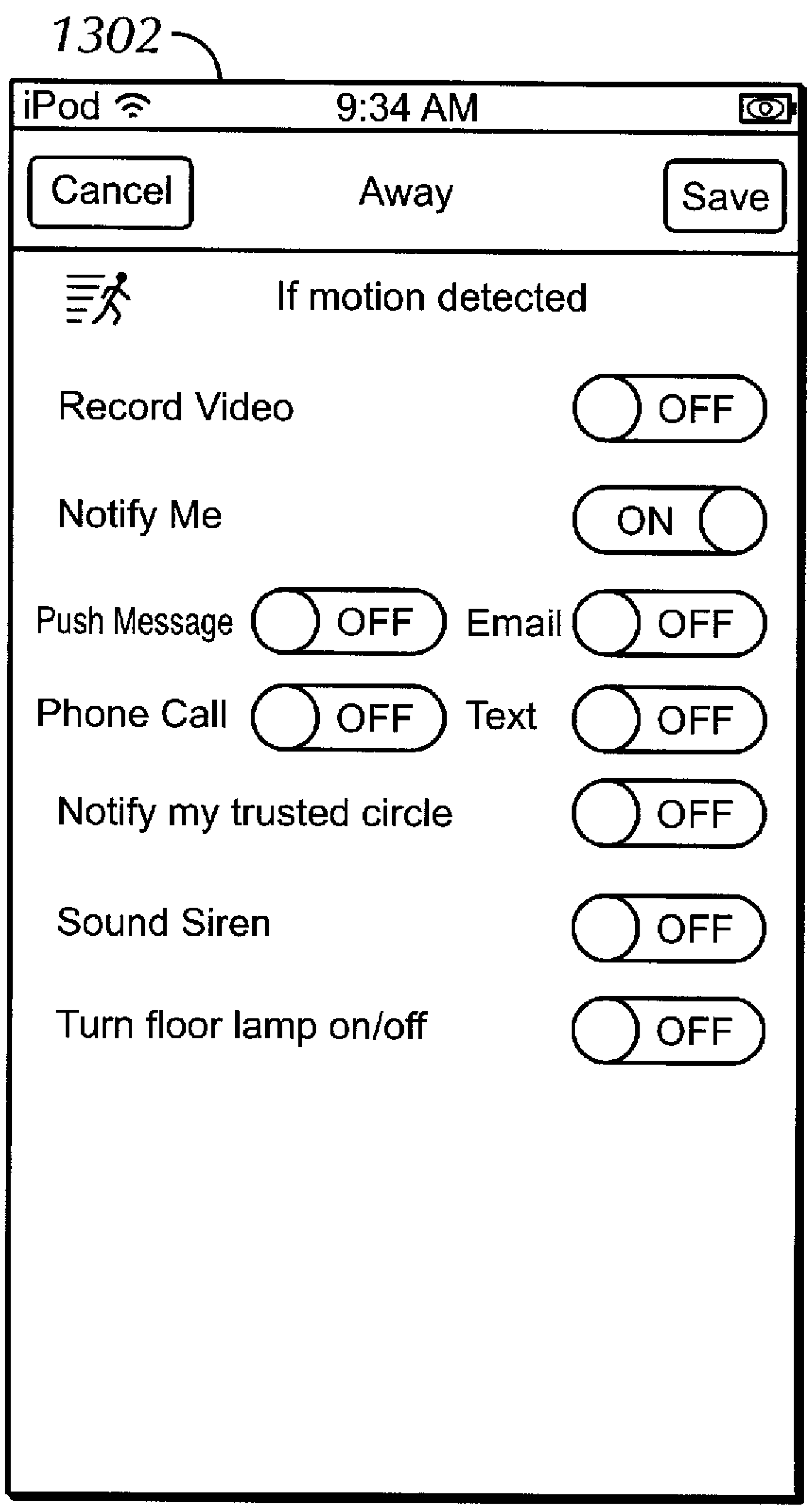
1302
iPod
9:34 AM
Cancel
Away
Save
If motion detected
Record Video
OFF
Notify Me
ON
Push Message
OFF
Email
OFF
Phone Call
OFF
Text
OFF
Notify my trusted circle
OFF
Sound Siren
OFF
Turn floor lamp on/off
OFF

FIG. 13B

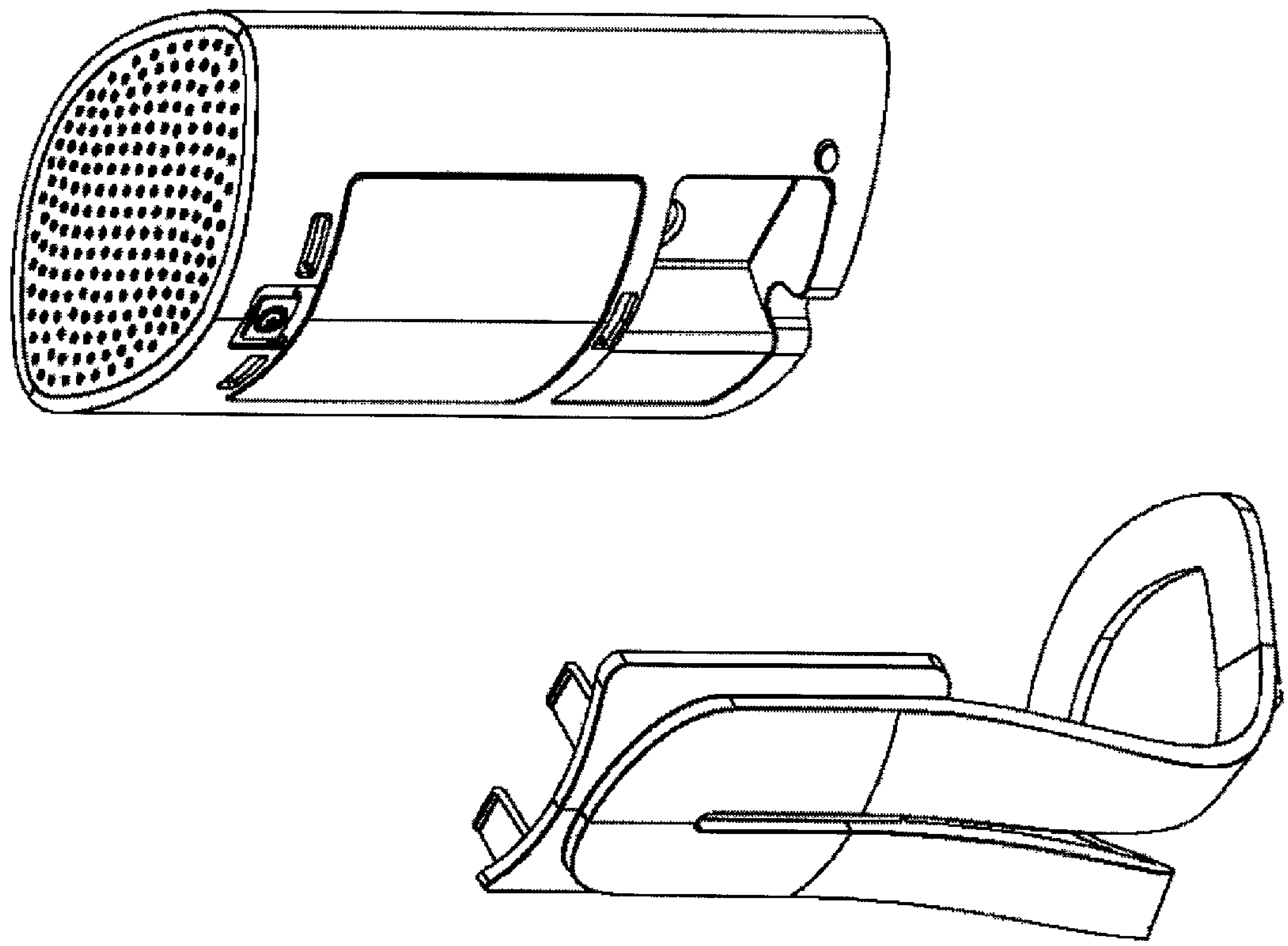

FIG. 14B

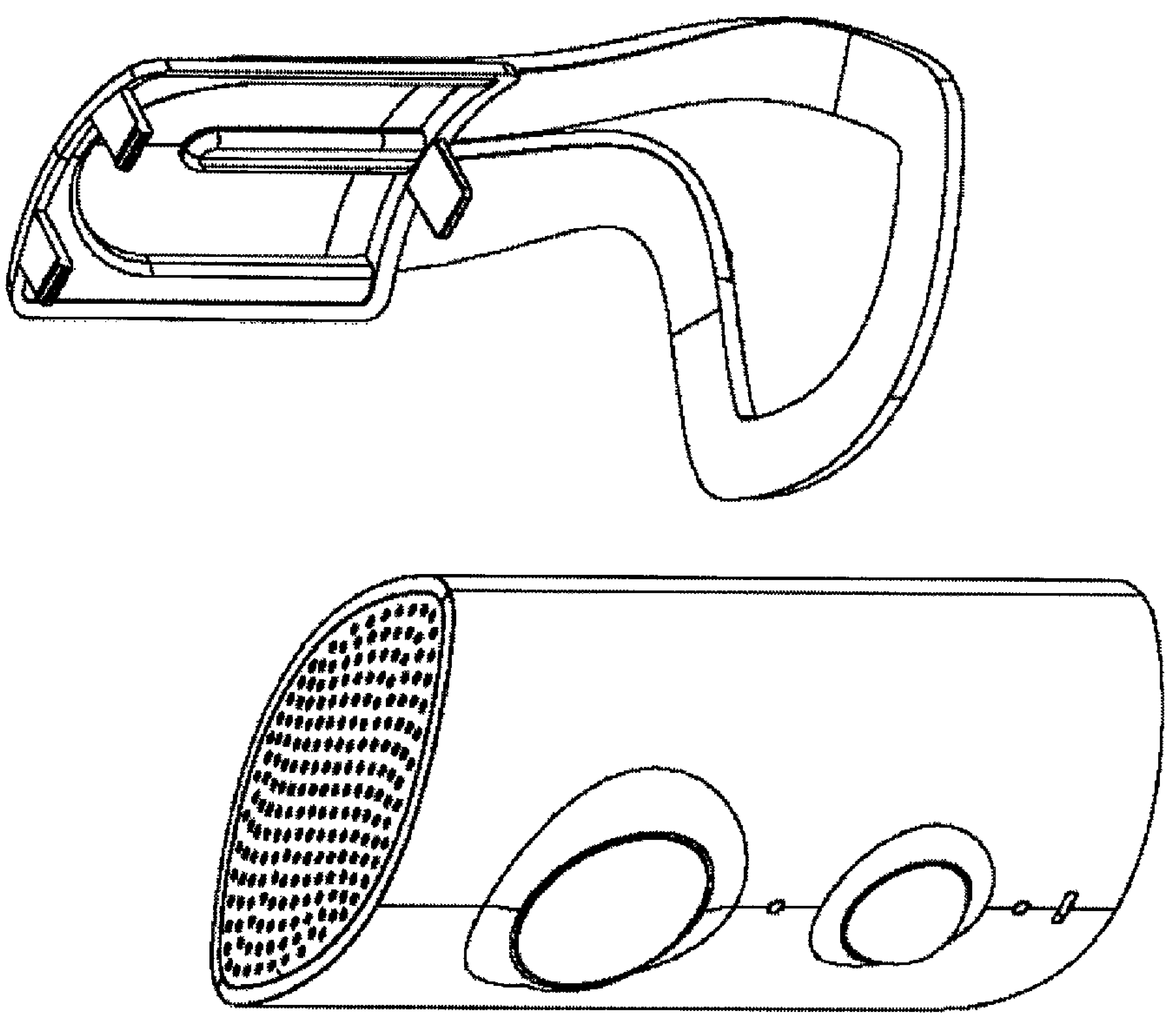

FIG. 14A

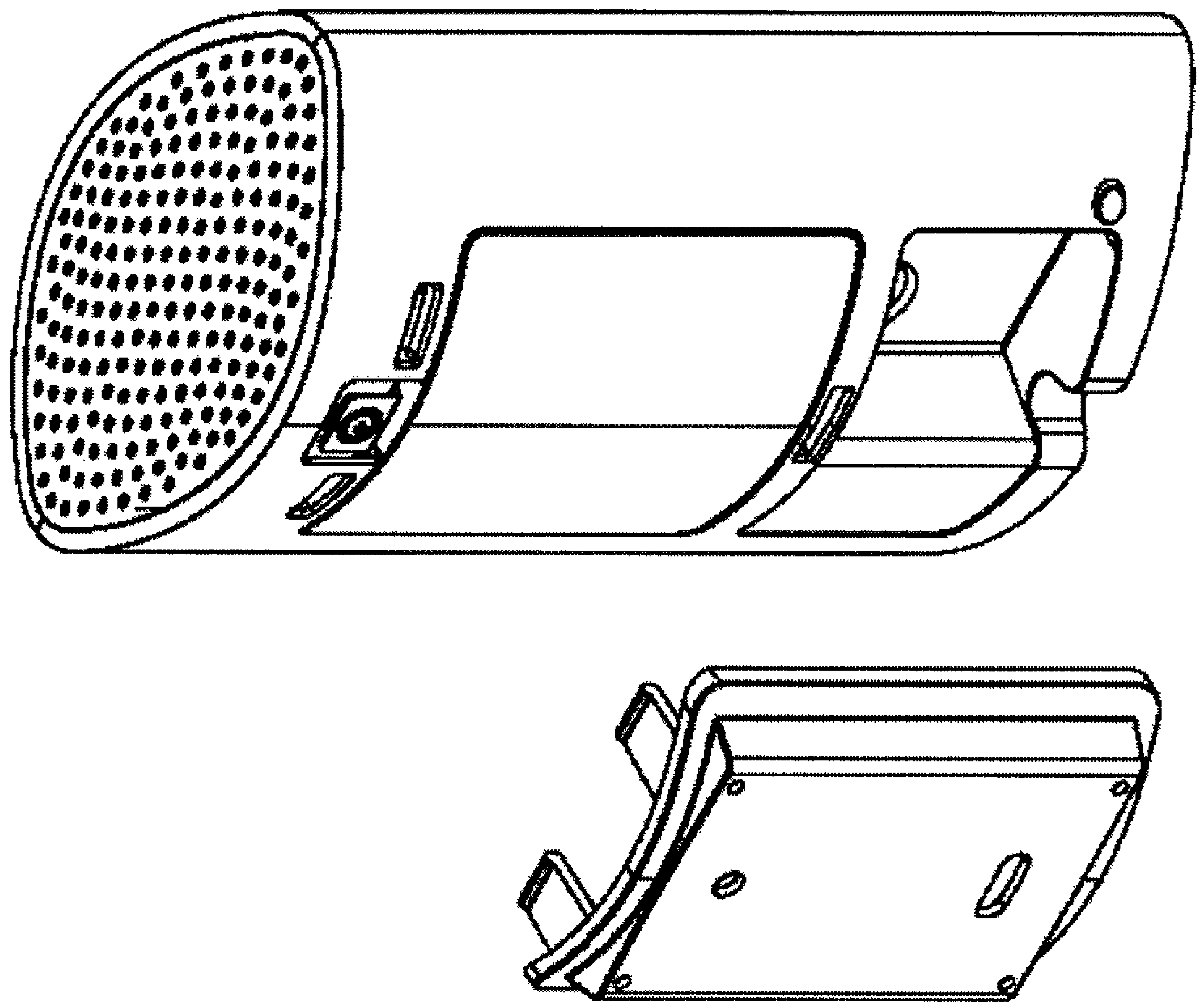

FIG. 15B

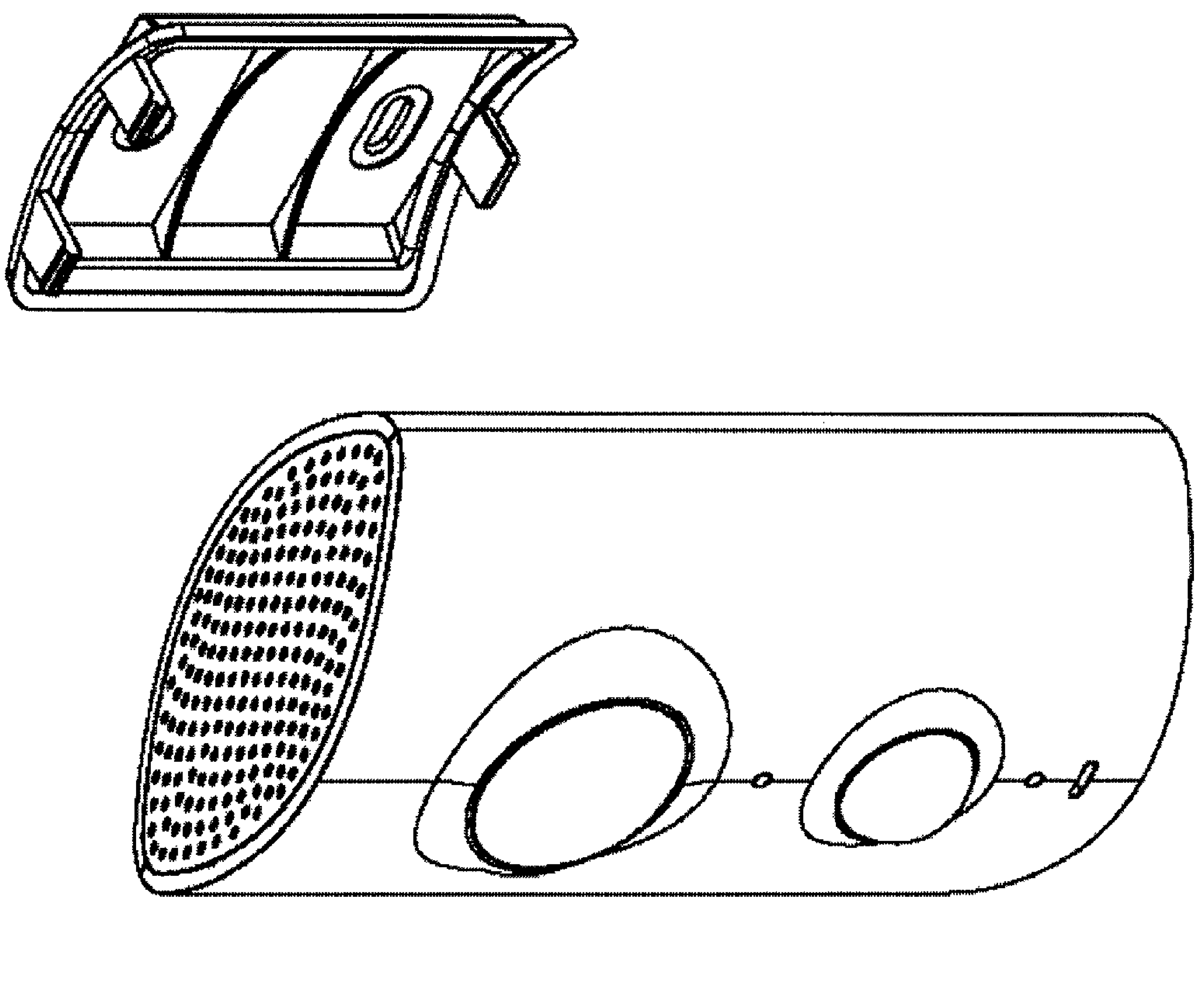

FIG. 15A

SYSTEM, METHOD AND APPARATUS FOR REMOTE MONITORING

RELATED APPLICATION

The present application claims the benefit of U.S. Patent Application No. 61/864,248, filed Aug. 9, 2013.

TECHNICAL FIELD

The present disclosure relates to monitoring systems and in particular to a web-based integrated monitoring system for small spaces.

BACKGROUND

Home security and monitoring systems require professional installation and require professional management and monitoring. For small spaces such as apartments, the installation of a monitoring system is not practical due to the investment required to install the system and the on-going expense to monitor and maintain the monitoring system. In addition, in the rental apartment market, landlords do not want the additional expense of a monitoring system and renters do not want to install as system as they cannot take it with them. Existing solutions require multiple components to be installed and provide limited controllability and monitoring capability. Accordingly, an improved monitoring system remains highly desirable.

INCORPORATION BY REFERENCE

Each patent, patent application, and/or publication mentioned in this specification is herein incorporated by reference in its entirety to the same extent as if each individual patent, patent application, and/or publication was specifically and individually indicated to be incorporated by reference.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1**A-**1**F show views of a monitoring unit, under an embodiment.

FIG. **2**A is a system overview of the monitoring system, under an embodiment.

FIG. **2**B is a system overview of the monitoring system **200**A, under an alternative embodiment.

FIG. **3** is a hardware block diagram of the monitoring system, under an embodiment.

FIG. **4** is a method of operation of the monitoring unit, under an embodiment.

FIG. **5** shows a block diagram of the monitoring unit firmware, under an embodiment.

FIGS. **6**A-**6**B is an example monitoring system dashboard user interface on a mobile device, under an embodiment.

FIG. **7** is an example monitoring system night stand mode user interface on a mobile device, under an embodiment.

FIG. **8** is an example monitoring system status screen on a mobile device, under an embodiment.

FIG. **9** is an example live streaming user interface display on a mobile device, under an embodiment.

FIG. **10** is an example live streaming multi-view user interface display on a mobile device, under an embodiment.

FIG. **11** shows monitoring system accessory control on a live streaming user interface on a mobile device, under an embodiment.

FIGS. **12**A-**12**C show control and scheduling screens for the monitoring unit on a mobile device, under an embodiment.

FIGS. **13**A-**13**B show a user interface for configuring rules for the monitoring system unit on a mobile device, under an embodiment.

FIG. **14**A is a front perspective view of the monitoring unit with a detachable stand, under an embodiment.

FIG. **14**B is a rear perspective view of the monitoring unit with a detachable stand, under an embodiment.

FIG. **15**A is a front perspective view of the monitoring unit with a detachable wall bracket, under an embodiment.

FIG. **15**B is a rear perspective view of the monitoring unit with a detachable wall bracket, under an embodiment.

DETAILED DESCRIPTION

Embodiments of a monitoring system are described herein. The monitoring system is configured for use in smaller spaces, for example, but is not so limited. The architecture of the monitoring system includes numerous layers that operate in concert to provide security, notification, video streaming, and home automation functions, as described in detail herein.

FIGS. **1**A-**1**F show views of a monitoring unit **100**, under an embodiment. FIG. **1**A shows a front view of the monitoring unit **100**. The monitoring unit **100** integrates multiple devices and/or operations into a compact form factor to provide monitoring functions. The monitoring unit **100** comprises a lens (e.g., fish-eye lens, etc.) with a camera **102** that operates to view a wide target area from a single location. A motion sensor **104** is included to detect motion within the target area. The monitoring unit **100** of an embodiment includes one or more environmental sensors for monitoring parameters of the local environment. For example, the monitoring unit **100** includes an ambient light sensor **106** and/or a temperature and humidity sensor **114**. The monitoring unit **100** also includes an indicator **108** (e.g., LED indicator, etc.) to provide visual status on the operation of the monitoring unit **100**. A microphone **110**, a speaker **112**, and a siren **116** are also included to detect noises in the environment, provide feedback, allow two way communications and alert noises. A stand **118** is coupled or connected to the monitoring unit **100** but may be removed for wall mounting applications.

FIG. **1**B is a perspective view of the monitoring unit **100**, under an embodiment. FIG. **1**C is a rear view of the monitoring unit **100**, under an embodiment. FIG. **1**D is a side view of the monitoring unit **100**, under an embodiment. FIG. **1**E is a top view of the monitoring unit **100**, under an embodiment. FIG. **1**F is a bottom view of the monitoring unit **100**, under an embodiment.

FIG. **2**A is a system overview of the monitoring system **200**, under an embodiment. The monitoring system **200** includes the monitoring unit **100** along with one or more additional components as appropriate to an installation of the monitoring unit **100**. For example, the monitoring unit **100** of an embodiment is coupled to a wide area network (e.g., the Internet) via a Wi-Fi router and/or cellular data coupling or connection. The system also includes an application for installation on a user's smartphone or tablet, and a web application accessible from any computer. Additionally, the system **200** includes a cloud-based back-end supporting the mobile application, web application, and device firmware.

FIG. **2**B is a system overview of the monitoring system **200**A, under an alternative embodiment. The monitoring system **200**A includes a plurality of monitoring units **100-1**/**100**-N (collectively referred to as **100**) along with one or more additional components as appropriate to an installation of the monitoring units **100**. For example, the monitoring units **100** of an embodiment are coupled to a wide area network (e.g., the Internet) via a Wi-Fi router and/or cellular data coupling or connection. The system also includes an application for installation on a user's smartphone or tablet, and a web application accessible from any computer. Additionally, the system **200**A includes a cloud-based back-end supporting the mobile application, web application, and device firmware of the monitoring units **100**. The monitoring system **200**A comprising a plurality of monitoring units is described in detail herein.

The monitoring unit is installed in a user's home (e.g., on the wall, using the provided wall-mount, on a flat surface, etc.) and is powered by a power source. The power source of an embodiment includes a Direct Current (DC) wall adapter, for example, but is not so limited. Battery-backup is available to ensure the security aspects of the system remain functional if there is a loss of power. The monitoring unit of an embodiment uses encryption for all outgoing and incoming data. A user can set up multiple monitoring units to monitor and secure several areas.

Users interact with the environment in which a monitoring unit is installed in a number of ways. The monitoring unit's mobile and web applications show current and historical environmental readings of its surroundings by reporting on temperature, humidity, ambient light and sound. This information is periodically uploaded by monitoring unit and stored in the cloud infrastructure using a time-series database. It is presented using current values and graphs in the Vitals section of the mobile and web application.

The monitoring unit's internal sensors provide a wealth of information or data about the device and its surroundings, for use in security and notification scenarios. The data provided includes but is not limited to information representing one or more of the following: unexpected motion within monitoring unit's field of view (FOV); temperature changes within the space; humidity changes within the space; physical movement of monitoring unit (due to vibrations or tampering); loud, unexpected sounds; and changes in ambient light.

The monitoring unit of an embodiment can be coupled or connected to various remote or peripheral devices or sensors. The monitoring unit includes a home area network (HAN) radio, or personal area network (PAN), to control and receive information from paired accessories such as sensors, switches, and dimmers. HAN-connected accessories can be controlled by way of security rules, a programmable schedule and internal sensor triggers such as ambient light and temperature. The HAN devices include but are not limited to IEEE 802.11 Wireless Local Area Network devices, and IEEE 802.15 Wireless Personal Area Network devices, for example Wi-Fi, Zigbee and/or Z-wave based devices, but are not so limited.

The monitoring unit includes couplings or connections among a variety of remote components like remote sensors and other devices at the premises, and supports discovery, installation and configuration of the remote devices coupled or connected to the system, as described in detail herein. The monitoring unit uses this self-generated sub-network to discover and manage the remote devices at the premises. The monitoring unit thus enables or forms a separate wireless and/or wired network, or sub-network, that includes some number of devices and is coupled or connected to the LAN or WAN of the host premises. The monitoring unit sub-network can include, but is not limited to, any number of other devices like wired devices, wireless devices, sensors, cameras, actuators, interactive devices, WiFi devices, and security devices to name a few. The monitoring unit manages or controls the sub-network separately or privately from other communications and transfers data and information between components of the sub-network and the LAN and/or WAN, but is not so limited.

The monitoring unit also provides a coupling or connection to a central monitoring station (CMS) data for remote monitoring of the premises. The data of an embodiment is provided to the CMS and to the remote device, but in other embodiments is provided to one of the remote device and the CMS. Under this embodiment, one or more monitoring units are coupled to the CMS via a network (e.g., one or more of WiFi, LAN, WAN, cellular, etc.). Alternatively, the monitoring units are coupled to the CMS via the network (e.g., WAN, cellular, etc.) and an intermediate server or device (e.g., remote server, etc.). In operation, the monitoring unit transmits collected data and information to the CMS based upon a user-selected state of the monitoring unit. The data transmitted by the monitoring unit includes data of the monitoring unit as well as data of and data received from devices coupled to the monitoring unit via the local sub-network. The monitoring unit automatically delivers data of one or more onboard and/or coupled devices to the CMS. The interactions and notifications between the monitoring unit and the remote CMS of an embodiment are controlled or managed by the mobile application running on the mobile device. As such, the user interface presented by the mobile application provides controls for enabling or disabling remote monitoring by the CMS; for example, a user can activate monitoring at the CMS via the mobile application when leaving town on a trip, and can deactivate CMS monitoring upon his/her return. The monitoring unit and remote server therefore provide a mechanism to activate and deactivate monitoring by the remote CMS.

An embodiment of this mechanism is an Application Programming Interface (API) using an interface technology such as REST or SOAP, for example, to send monitoring activation and deactivation messages to the CMS and to receive acknowledgements from the CMS. Other embodiments such as the client application, monitoring device, or remote server utilize the user selection to enable/disable the delivery of activity messages to the CMS, where the CMS is always available and uses the presence of messages to trigger monitoring periods. The current invention also anticipates the integration of the CMS billing system into the service to enable on-demand billing of monitoring services, and/or to offer time-based monitoring of the system (e.g. the CMS monitoring is active for a specific period of time).

Users can place the monitoring unit into one of a plurality of security modes (e.g., Home, Away, Vacation, Off) using the mobile application, thereby activating and deactivating the various security preferences (defined as rules). Other security modes, such as 'CMS Monitoring mode' for example, can be utilized as well to effectuate different behaviors for the device and/or for its monitoring. Rules and other configurations may be stored on the monitoring unit's firmware and as such do not require a centralized server environment. In another embodiment these rules and configurations are stored on a remote server or backed up to a remote server to facilitate replacement of a defective unit.

The monitoring unit's mobile application allows users to set rules for each security mode pertaining to notifications, home-automation actions and alarms based on a set of scenarios. Under a scenario, the monitoring unit's various sensors (both internal and externally paired) can alert a user to activity within their environment, using data from sensors. The notification options of an embodiment include but are not limited to mobile push, SMS messages, telephone calls, and electronic mail to name but a few.

Under another scenario, sensors and their corresponding actions are configured by way of the mobile application. The monitoring unit can also leverage the use of externally paired HAN sensors to drive actions and notifications. The HAN sensors can include one or more of thermostats, door sensors, actuators, door locks, garage openers, window sensors, light dimmers or switches, to name a few.

The monitoring unit under yet another scenario allows rules associated with sensors (whether externally-paired or internal) to control connected appliances by way of paired HAN dimmers and switches. Furthermore, the monitoring unit can control the state of HAN-connected appliances by way of a configurable schedule, based on time and/or sunrise/sunset based on installed location.

The monitoring unit allows a user to set up notification-only rules that are outside the scope of any security modes. These rules can result in mobile push notifications derived from the same sensors that trigger security mode rules.

The monitoring unit can alert the surrounding environment to a potential breach of security by way of a very loud siren, driven by rules associated with sensors, both internal and externally paired. The siren can also be triggered by external parties such as the CMS and/or the user from a remote device. This capability allows a remote entity to interact with the device to warn occupants or deter an intruder. Moreover, the monitoring unit's system receives weather and other environmental information. This can influence rules and also provide additional environmental status to the mobile and web applications.

The monitoring unit allows users to connect to a live stream of video and audio via their mobile application or any remote device. This video is captured and streamed using a very wide field-of-view (FOV) lens, allowing the user to electronically pan, tilt, and zoom within their space. Additionally, multiple angles of the captured live stream can be viewed at once, in a segmented fashion. Each segment represents a distinct view of the monitoring unit's surroundings and the direction and zoom level chosen by the user are retained when a user returns to the live stream.

Conventional video cameras using a wide angle lens and local on-camera 'de-warping' removed the distortion imparted by the wide angle lens locally on the camera processor to produce a flattened image, and then streamed portions or all of the flattened image to a remote device. In these systems the remote device displayed the de-warped video, but had no ability to simulate the raw video data being presented by the lens. These conventional systems therefore were optimized for lower-end remote devices that were not capable of advanced video processing.

In contrast to these conventional camera technologies, the monitoring unit described herein comprises 'Immersive 3D video streaming', which transmits lens-warped video data collected at the camera to the remote device where it is de-warped. In an embodiment, the raw lens-warped video data collected at the camera is transmitted or streamed to the remote device in a highly compressed format; in various alternative embodiments the warped video data collected at the camera can be clipped or processed in some manner before being compressed and transmitted or streamed. Regardless of any pre-processing technique applied to the video data collected at the camera, the embodiments described herein transmit or stream warped video data from the monitoring unit to the remote device, and the remote device performs de-warping of the video data. However, other alternative embodiments can de-warp the video data at the monitoring unit prior to transmitting the data stream to a remote device.

The local processor of the remote device manipulates the received video data to provide an optimal user experience. A key distinction in this approach is the ability to rely upon the high performance video decoding and three-dimensional (3D) manipulation capabilities present in state of the art remote devices, which include but are not limited to smart phones, tablet computers, personal computers, and other mobile and/or portable processor-based devices. Generally, the Immersive 3D video streaming process executing on the remote device decodes and decrypts the video stream to a raw video frame buffer, creates a 3D space that emulates the specific lens geometry of the camera, and maps the video frame buffer to the 3D space providing an 'immersive 3D video view' that allows the remote device to zoom, pan, and move around in the 3D space giving the perception of being 'inside the lens looking around'.

The monitoring unit of an embodiment generates a Immersive 3D video stream using components comprising a lens with a wide-angle geometry, as described in detail herein, that 'warps' or distorts the video to obtain the wide-angle view. The monitoring unit includes an image encoder that encodes the video image into a compressed streaming format. The monitoring unit of an embodiment stores the compressed streaming format with warped video to a local storage device coupled to the monitoring unit. Alternatively, the monitoring unit stores the compressed streaming format with warped video at a remote server or other remote processing component or memory to which it is coupled via a network coupling (e.g., LAN, WAN, Internet, etc.). Alternative embodiments may use other devices (e.g., a local Digital Video Recorder-DVR, etc.) to accomplish the process of encoding, compression, and storage separately from the monitoring device itself.

The monitoring unit streams the compressed video to a remote device (e.g., smart phones, tablet computers, personal computers, other mobile and/or portable processor-based devices, etc.). The monitoring unit of an embodiment streams the compressed video directly to the remote device. Alternatively, however, the monitoring unit streams the compressed video to the remote device via an intermediate server (e.g., relay server, intermediate DVR, etc.).

The remote device decompresses the received compressed video stream. The remote device decompresses the video stream and then further processes the resulting decompressed video images using data of the camera lens geometry, more specifically the wide-angle geometry (de-warping) of the camera lens. For example, the remote device of an embodiment decompresses the video stream using a software codec (e.g. FFMPEG) executing on a processor. The remote device of an alternative embodiment decompresses the video stream using a hardware codec. The remote device uses 3D rendering technology to map the warped video to a 3D space replicating the lens geometry. The data of the lens geometry used by the remote device to process the received video stream is used by the mobile application, under an embodiment, and is one or more of received dynamically from a remote server or monitoring unit, included in a mapping table at the mobile device, and known a priori, but is not so limited. In an alternative embodiment the lens geometry is specified as part of the data interchange associated with the video feed setup. In yet another alternative embodiment the mobile application stores data of a plurality of known lens geometries associated with the camera types supported by the application.

The remote device 'maps' the decompressed warped image to the 3D space representing the lens geometry and displays this 3D view using a display that is a component of or coupled to the remote device. The remote device includes a user interface that enables a user to 'move' around the environment of the monitoring unit by panning and zooming around the 3D space and the mapped video image. The user interface of an embodiment is generated by the mobile application, but is not so limited. The user interface of an embodiment enables a user to navigate the 3D space using pinching gestures and swiping gestures when the remote device includes a touchscreen display. Additionally, the remote device enables playing of and interacting with stored video clips generated by the monitoring unit, where the stored video clips are stored at local storage or remote server in the same way.

By way of example in an embodiment, the process for a remote device to receive the Immersive 3D video stream from the monitoring unit comprises the remote device creating a tunnel (e.g., Secure Sockets Layer (SSL), etc.) to the monitoring unit by coupling or connecting to an external port that was configured by the monitoring unit (e.g., using Universal Plug and Play (UPnP), etc.). The monitoring unit encodes the raw video image (e.g., 1280×1070) using an encoder application (e.g., H.264 with High Profile, etc.). The monitoring unit sends the encoded video stream to the mobile device using the tunnel (e.g., sends video stream using RTP tunneled in RTSP).

The mobile device of this example embodiment includes a multimedia data library (e.g., FFmpeg library, etc.) that decodes packets of the video stream (e.g., Real-time Transport Protocol (RTP) packets of H.264 stream) to an image buffer (e.g., a YUV color space image) in memory. The size of the memory buffer of an example is 1280×1070, but is not so limited. The mobile device creates an a virtual surface (e.g., Open Graphics Library (OpenGL)) through an API for rendering vector graphics. The virtual surface of this example embodiment is YUV for rendering the pan/zoomed image, where the image size is based on the mobile device, but the embodiment is not so limited. The mobile device user interface includes controls (e.g., pinch with fingers, zoom with fingers, etc.) for selecting a position of the rendered image on the display of the mobile device. Based on the selected position on the image, the mobile device takes a portion of the decoded image (e.g., YUV) and executes a de-warping and scaling algorithm (e.g., OpenGL) to produce a rendered subset image into the image surface.

Users interact with their premises during a live-streaming session by controlling appliances and speaking into their space through the monitoring unit's built-in two-way audio functionality, which streams live audio from the mobile application to the monitoring unit's speaker. The monitoring unit supports two-way voice sessions under numerous embodiments. For example, a remote device of an embodiment initiates a two-way voice session with one or more monitoring units at a premises. Similarly, a third-party monitoring station initiates a two-way voice session with one or more monitoring units at a premises. Additionally, the monitoring unit provides live video contemporaneously with or as a component of the two-way voice session with the remote device and/or third party monitoring station. The two-way voice sessions include sessions over a WAN (e.g., Internet Protocol (IP) via WiFi, etc.) and/or sessions over a cellular network (e.g., cellular voice, IP data, etc.), but are not so limited.

The monitoring unit can record video of events associated with rules triggered by internal and externally paired sensors. The monitoring unit of an embodiment continuously records video and audio in a loop, enabling it to report on an event by presenting footage before and after it occurs. Users can review these recorded events on the mobile and web applications and perform electronic pan, tilt, and zoom operations within the captured video, as though they were streaming it in real time.

The monitoring unit records a longer video if subsequent events happen in rapid succession. A single video is created which encapsulates the several events in question. The system understands that this particular video maps to several events, and vice-versa.

The monitoring unit allows users to record video in an on-demand fashion, triggered from the mobile and web applications. As with event-driven footage, users can perform electronic pan, tilt, and zoom operations within the captured on-demand video recordings via the mobile and web applications. The monitoring unit also includes smart sound detection, allowing captured loud sounds to be fed to characterization software which helps identify it, (e.g. a smoke alarm, barking dog, etc.).

The monitoring unit periodically transmits a heartbeat signal or message to the cloud or other network infrastructure, allowing the user to be notified when the monitoring unit disconnects from the Internet. The user is also notified when the monitoring unit reconnects and continues to post heartbeat information. If connectivity issues arise and events trigger video recording, the monitoring unit saves videos locally and queues them for later upload, when connectivity resumes.

The cloud infrastructure of an embodiment comprises one or more of a number of components. The components include for example, front-end web services the expose or include an Application Programming Interface (API) for both the mobile application and the monitoring unit firmware. This public traffic is encrypted and authentication is performed against strong firmware and user credentials. Additionally, back-end databases include user account information and settings, and monitoring unit configuration and time-series sensor and event data. Back-end in-memory databases house real-time sensor history, cached data and heartbeat information.

The cloud infrastructure components also include notification services and worker services. The notification services send information to users by way of direct and third-party assisted methods. These include email, mobile push notifications, SMS and voice calls. The worker services process uploaded content, check in-memory real-time data for connected devices' heartbeats, trigger notifications, start on-demand recordings for users and perform additional infrastructure and product-related functions. File storage services providing fast and reliable disk space for the entire infrastructure.

Additionally, the cloud infrastructure components include infrastructure backup services, multi-site disaster recovery for database, worker and web services, and redundancy for each component. High availability for all worker and web services is provided by way of application-level clustering and load balancing for incoming web service requests from mobile apps and firmware.

Multiple monitoring units are installed at various independent locations at a premises, and when so installed function as a distributed premises security system, under an embodiment and as described herein. The monitoring units of this collective installation automatically discover and couple to each other and share data over a device network (e.g., IP, WiFi, wired connection, Z-Wave, etc.) that is separate and independent from a LAN and/or WAN to which the monitoring units are coupled at the premises. In an embodiment the monitoring units utilize the LAN (Wifi, Ethernet, etc.) to couple to each other and share data. In another embodiment the monitoring units utilize a WAN (such as a cellular or broadband network) to couple to each other and share data. In yet another embodiment the monitoring devices are installed in physically remote locations (such as a home and an office) and are coupled via a WAN, but can still share data and form a distributed security network. The monitoring units thereby combine logically to form an integrated monitoring or security network at the premises or between premises. Each monitoring unit includes an automatic installation process for adding and removing itself from this integrated network. The monitoring units are configured to repeat at least one message between devices in the integrated security network formed by the coupling of the devices. When the installation includes multiple monitoring units, the collection of monitoring units are controlled or monitored from a single mobile application and are associated and managed with a single user account. Similarly, the collection of monitoring units is coupled to a remote service and monitored at the CMS.

FIG. **3** is a hardware block diagram of the monitoring system, under an embodiment. The monitoring unit's hardware architecture comprises but is not limited to one or more of the following components: ARM System-on-chip **302**; DDR Memory **304**; Flash storage **306**; Home area network RF module with antenna **308**; Wi-Fi (or local area network technology) module with antenna **310**; Cellular data module with antenna **312** if provisioned; Camera system comprising a multi-megapixel CMOS sensor and very wide FOV lens **314**; Audio system comprising a microphone **316** and speaker **318**; Alarm siren **320**; Passive infrared (PIR) motion sensor with a very wide FOV Fresnel lens **322**; Temperature sensor **324**; Relative humidity sensor **326**; Accelerometer **328**; Ambient light sensor **330**; Power system **332** comprising a DC jack **334** and battery compartment **336**; RGB LED indicator **338**; Push-button **340**.

FIG. **4** is a method of operation of the monitoring unit, under an embodiment. The monitoring unit's firmware is based upon an operating system such as Linux, for example, but is not so limited. Specialized software or applications along with this operating system provides the services, API and functionality for set up and use of the monitoring unit's features in concert with the cloud infrastructure and mobile and web applications.

During the user's initial setup of monitoring unit, the following tasks are performed by the firmware:

a. The monitoring unit's firmware boots.

b. Since no existing device information is present, the monitoring unit creates a Wi-Fi access point for setup functions.

c. User launches the mobile application and after creating an account using their information begins the setup process.

d. User connects to monitoring unit's Wi-Fi access point and submits Wi-Fi credentials for their home network.

e. The monitoring unit attempts to connect with the home network using the provided Wi-Fi credentials.

f. The monitoring unit registers itself to the cloud back-end, associates with the current user and attempts to open ports on the user's Internet router (for incoming connections) using Universal Plug and Play (UPNP) or Network Address Translation (NAP) Port Mapping Protocol (PMP), depending on the type of router present.

g. Once fully connected, the monitoring unit turns off its Wi-Fi access point and begins normal operation.

h. In the cases where a new Wi-Fi router is present, the monitoring unit has moved to a new environment, or connectivity to the existing router fails, the monitoring unit can accept new Wi-Fi credentials in a similar fashion to the initial setup process.

Embodiments described herein include a setup or enrollment process that comprises determining geolocation of the monitoring unit during installation at the premises. The monitoring unit of an embodiment incorporates a WiFi module (processor and radio (802.11)), and during enrollment the monitoring unit puts the WiFi module into 'Access Point mode'. The mobile device running the mobile application described in detail herein enrolls as a WiFi client to the monitoring unit access point. The mobile application then provides new WiFi credentials (e.g., service set identification (SSID), password (optional), etc.) to the monitoring unit via the WiFi access point; subsequently, the mobile application automatically switches the mobile device over to the same WiFi SSID, or the user manually switches the mobile device to that SSID using a network configuration utility. Upon receipt of the new WiFi credentials, the monitoring unit automatically switches its WiFi processor to enroll as a client at the new WiFi SSID (using the optional password). Either the monitoring unit or the mobile application initiates a process to store the WiFi credentials on a remote server or other remote device. The monitoring unit of an embodiment restores the WiFi credentials from a remote server, but the remote server of an alternative embodiment initiates restoration of the WiFi credentials of the monitoring unit.

The mobile application of an embodiment provides numerous operations, but is not so limited. For example, the mobile application provides a user interface that enables a user to switch the monitoring unit to the access point mode in order to change the SSID. The mobile application provides authentication directly to the camera (e.g. username, password, etc.). Alternatively, the mobile application provides authentication against a remote server.

The mobile application provides to one or more monitoring units location information corresponding to the monitoring unit installation, where the location information corresponding to the monitoring unit is location data determined at the mobile device. The monitoring unit then provides its location data to the remote server. Alternatively, the mobile application provides the location data of the monitoring unit installation directly to a remote server or other remote device. The monitoring unit of an embodiment includes an administrative tool that provides information about numerous monitoring units and their respective physical locations.

In an alternative embodiment the monitoring unit is temporarily coupled or connected via a physical connector (e.g. a USB cable) to a mobile device running the mobile application. In this embodiment the mobile application delivers the Wifi SSID and password over the wired connection, and the monitoring device then switches to the Wifi access point as described above.

Generally, the monitoring unit's operating state comprises but is not limited to the following:

a. Sensor polling is running and receiving raw data from sensors.

b. The rules engine is running and can interface with sensors.

c. The audio and video service and RTSP server are running and are ready to accept incoming connections, record footage in a loop and detect loud sounds.

d. The PIR motion sensor service is running and able to detect movement within the monitoring unit's FOV.

e. Automated tasks run at their pre-defined intervals and perform, but are not limited to, one or more of the following: maintain contact or communication between the monitoring unit and the cloud back-end and ensure incoming ports remain open on the user's Internet router; check for updates to the monitoring unit's firmware; post status updates about the current environment around the monitoring unit; post heartbeats periodically to inform the cloud backend of the monitoring unit's state.

Sensors and Rules

The sensor polling service reads from internal sensors (e.g., temperature, humidity, ambient light, acceleration/motion, etc.) and sends the data to the rules engine. It can also receive a signal from any other part of the firmware to force an immediate read of the sensors. All sensor data is sent to the rules engine.

The PIR motion sensor service reads from the PIR software driver directly, but is not so limited. The motion sensor, which implements a Bessel filter in order to eliminate false positives, issues a message to the Rules engine if a threshold for motion is exceeded.

When loud sound above a predefined threshold is detected, a signal is passed to the rules engine. When appropriate, the loud sound in question is passed through characterization software to help identify it, (e.g. a smoke alarm, barking dog, etc.).

The rules engine loads a list of rules for notifications for the current security mode (home, away, or vacation) from a database into memory. The rules engine also loads any HAN control rules that can be controlled via schedule, ambient light, temperature or any other sensors, be they internal or external. Notification-only rules are processed in parallel to mode-based security rules.

The rules engine saves the data with a timestamp in the monitoring unit's firmware database. The data is also sent to each active rule/control in order to determine what action, if any, should be taken (e.g. turn on an appliance, sound the siren, notify the user etc.).

Audio and Video

The audio and video service is responsible for streaming media, saving to a file and detecting loud sounds.

For saving footage to a file, audio and video are encoded and placed into a circular buffer of a certain time. This enables the monitoring unit to capture video and audio "before" an event has occurred. This queue is operating when the system is on but is not so limited.

For streaming, video and audio are encoded and served via RTP/RTSP to a user's mobile application. The streaming is encrypted and supports multiple clients at once.

FIG. **5** shows a block diagram of the monitoring unit firmware, under an embodiment. The mobile application is the user's interface to the monitoring unit. The mobile application is executed on a smartphone or other personal or mobile electronic device. Within the application, the user's account is created, security and notification rules are defined, environmental readings are displayed, live streaming takes place and other settings are submitted to the cloud back-end and the monitoring unit's firmware. The application also serves as a tool to set up the monitoring unit's hardware, enabling the monitoring unit to pair with the user's home Wi-Fi network.

Key functions are accessed from the application's tab bar at the bottom of the screen, once the user has logged into their account.

FIGS. **6A-6B** show an example monitoring system dashboard user interface on a mobile device, under an embodiment. The Dashboard provides an at-a-glance view of the monitoring unit's system and provides access to one or more of the following functions: the monitoring unit's current security mode; the temperature near the monitoring unit; the monitoring unit's Wi-Fi signal strength; current status of HAN-connected accessories; weather alerts, if present; access to Events, Recordings, and Settings; access to the Night Stand.

FIG. **7** is an example monitoring system Night Stand mode user interface on a mobile device, under an embodiment. The user can activate the Night Stand mode (available from the Dashboard), providing access to the various HAN-connected control accessories, a clock, weather information, and a panic button. Pressing the panic button activates the monitoring unit's siren.

FIG. **8** is an example monitoring system status screen on a mobile device, under an embodiment. The Vitals section displays monitoring unit's internal sensor readings and external weather information in an easy-to-understand format. Historical information is displayed using graphs allowing the user to see trends for each reading.

FIG. **9** is an example live streaming user interface display on a mobile device, under an embodiment. Tapping or selecting the center icon of the mobile application's tab bar launches live streaming and couples or connects the user securely to the monitoring unit's built-in wide FOV camera. The user can then pan, tilt, and zoom the live stream of monitoring unit's surroundings, control connected HAN plug-in modules (e.g. turning on a light) and stream audio from the microphone of their mobile device to the user's space by way of monitoring unit's built-in two-way audio feature.

FIG. **10** is an example live streaming multi-view user interface display on a mobile device, under an embodiment. Users can also choose to switch to a multi-view version of the live stream, which allows them to look at different areas of their space at the same time. This is achieved by presenting the user with several smaller views of the pan, tilt, and zoom video. The video image is segmented allowing multiple areas within the field of view of the camera to be isolated. The image captured by the camera has wide angle viewing area such as provided by a fish-eye lens. The image maybe de-warped and post-processed to provide a more viewable image. The monitoring unit remembers the last-used settings of the live stream, including the direction the user was looking and the zoom level of the video.

FIG. **11** shows monitoring system accessory control on a live streaming user interface on a mobile device, under an embodiment. If the user has paired HAN control accessories to monitoring unit, they can be accessed and controlled from within the live video screen. This allows a user to turn an appliance on or off and see the results in real time, if desired.

FIGS. **12A-12C** show control and scheduling screens for the monitoring unit on a mobile device, under an embodiment. The Controls section allows configuration and control of HAN-connected accessories. These accessories can be configured via one or more of a timed schedule, sunrise/sunset, ambient light level, and temperature.

FIGS. **13A-13B** show a user interface for configuring rules for the monitoring system unit on a mobile device, under an embodiment. The rules section allows the user to set security-related actions for motion, loud sound and temperature change triggers. Actions can be set for each security mode and include but are not limited to one or more of the following: record video and audio of the event; notifications; push message; electronic mail; phone call; SMS message; notification to a user's Trusted Circle members; the sounding of the monitoring unit's built-in siren; control of any connected HAN switches.

Additionally, notification-only options are present which allow the user to be informed of events outside the scope of the current security mode.

Additional functionality may be provided by the camera such as motion detection and ambient light detection. The processor may use image processing to determine characteristics of the image for use in motion detection, face recognition or light detection. In addition the microphone may be used for voice recognition function of the monitoring unit.

FIG. **14**A is a front perspective view of the monitoring unit with a detachable stand, under an embodiment. FIG. **14**B is a rear perspective view of the monitoring unit with a detachable stand, under an embodiment.

FIG. **15**A is a front perspective view of the monitoring unit with a detachable wall bracket, under an embodiment. FIG. **15**B is a rear perspective view of the monitoring unit with a detachable wall bracket, under an embodiment.

Embodiments described herein include a monitoring unit comprising a camera. The monitoring unit comprises a network interface. The monitoring unit comprises a processor coupled to the camera and the network interface. The monitoring unit comprises at least one application executing on the processor. The processor receives an image from the camera. The processor receives sensor data from at least one sensor coupled to the processor. The processor generates an alert based upon a change in at least one of the image and the sensor data. The alert is sent via the network interface to a mobile device.

Embodiments described herein include a monitoring unit comprising: a camera; a network interface; a processor coupled to the camera and the network interface; and at least one application executing on the processor, wherein the processor receives an image from the camera, wherein the processor receives sensor data from at least one sensor coupled to the processor, wherein the processor generates an alert based upon a change in at least one of the image and the sensor data, wherein the alert is sent via the network interface to a mobile device.

The monitoring unit of an embodiment comprises at least one a memory device coupled to the processor.

The monitoring unit of an embodiment comprises at least one communication module coupled to the processor.

The at least one communication module comprises a home area network (HAN) radio frequency (RF) module.

The at least one communication module comprises a Wi-Fi module.

The executing of the at least one application generates an enrollment process.

The enrollment process automatically places the WiFi module into an Access Point mode.

The mobile device comprises a mobile application, wherein the mobile application enrolls as a client to the Access Point.

The mobile application provides WiFi credentials to the processor via the Access Point.

At least one of the mobile application and the processor initiate storage of the WiFi credentials on a remote server.

At least one of the remote server and the processor restore the WiFi credentials from the remote storage device.

The mobile application provides authentication against at least one of the processor and a remote server.

The processor automatically switches the WiFi module to enroll as a client using the WiFi credentials.

The mobile application automatically switches the mobile device to enroll using the WiFi credentials.

The mobile application provides a user interface that includes at least one control for switching the processor to the Access Point mode to change the WiFi credentials.

The mobile application provides to a device location information corresponding to installation of the monitoring unit.

The device comprises a remote server.

The device comprises at least one of the monitoring unit and at least one additional monitoring unit.

The monitoring unit of an embodiment comprises an administrative application that provides information about at least one monitoring unit that includes the location information.

The at least one communication module comprises a local area network (LAN) module.

The at least one communication module comprises a cellular data module.

The at least one communication module is coupled to a remote device to communicate with the remote device.

The at least one communication module is coupled to a remote device to communicate over an Internet Protocol (IP) channel.

The at least one communication module is coupled to a remote device to communicate over a cellular channel.

The communication comprises a two-way voice session with the remote device.

The communication comprises a data session, wherein video images are transmitted during the data session.

The remote device comprises the mobile device.

The remote device comprises a central monitoring station.

The communication module automatically establishes a coupling with the at least one sensor.

The communication module automatically establishes a coupling with a local area network (LAN) at the premises.

The at least one application transfers data between at least one device on the LAN.

The communication module forms a sub-network at the premises.

The sub-network is a private network.

The at least one sensor is coupled to the sub-network.

Devices couple to the sub-network and communicate over the sub-network, wherein the devices include at least one of wireless devices, wired devices, and IP devices.

The monitoring unit of an embodiment comprises a remote server including a user account coupled to the processor.

The camera comprises an image sensor and a lens.

The camera comprises a lens including a wide-angle geometry, wherein the camera generates images including warped images, wherein the camera generates the images using a wide-angle view mapped to the geometry of the lens from collected images.

The camera comprises an encoder that encodes collected images to generate a processed data stream.

The processed data stream is a compressed video stream.

The monitoring unit of an embodiment comprises memory coupled to the camera, wherein the camera stores to the memory the processed data stream that includes warped video.

The memory is local to the camera.

The memory is remote to the camera.

The camera streams the processed data stream to a remote device, wherein the remote device comprises at least one of a mobile device and a server.

The camera streams the processed data stream directly to the remote device.

The camera streams the processed data stream to the remote device via at least one intermediary device.

Remote device processes the processed data stream using knowledge of a wide-angle geometry of the lens.

The processing comprises decompressing the processed data stream.

The remote device comprises a software codec, wherein the software codec decompresses the processed data stream.

The remote device comprises a hardware codec, wherein the hardware codec decompresses the processed data stream.

The processing comprises using three-dimensional (3D) rendering and mapping warped video to a 3D space representing at least a portion of the lens geometry.

The processing comprises displaying a 3D view of the collected images via a display coupled to the remote device.

The remote device comprises a user interface comprising control gestures for navigating around the 3D view presented via the display.

The navigating comprises at least one of panning and zooming around the 3D view presented via the display, wherein the control gestures comprise at least one of pinching gestures and swiping gestures.

The camera comprises at least one of a video camera and an imaging camera.

The camera comprises a CMOS sensor and very wide FOV lens.

The monitoring unit of an embodiment comprises an audio system.

The monitoring unit of an embodiment comprises an alarm siren.

The at least one sensor comprises a motion sensor.

The motion sensor comprises a passive infrared (PIR) motion sensor with a very wide FOV Fresnel lens.

The at least one sensor comprises an environmental sensor.

The environmental sensor comprises at least one of a temperature sensor and a humidity sensor.

The at least one sensor comprises an accelerometer.

The at least one sensor comprises an ambient light sensor.

The monitoring unit of an embodiment comprises a power system.

The monitoring unit of an embodiment comprises at least one indicator coupled to the processor.

The at least one application generates at least one notification.

The at least one notification comprises one or more of a push message, an electronic mail, a telephone call, a Short-Message-Service (SMS) message, a notification to at least one contact.

The monitoring unit is coupled to one or more accessories.

The accessories are controlled by at least one of a timed schedule, a sunrise/sunset event, an ambient light level, and a temperature.

The monitoring unit of an embodiment comprises a rules engine executing on the processor.

The monitoring unit of an embodiment comprises a mobile application installed on the mobile device.

The mobile application generates a user interface presented on the mobile device, wherein the user interface provides access to at least one of the image and the sensor data.

The at least one application is at least one of accessed and controlled using the user interface.

The at least one sensor is controlled via the user interface.

The monitoring unit of an embodiment comprises at least one actuator coupled to the processor, wherein the at least one actuator is controlled via the user interface.

The monitoring unit of an embodiment comprises a heartbeat signal generated by the processor and transmitted to a remote device.

The monitoring unit of an embodiment comprises at least one remote server coupled to the network interface.

The coupling comprises at least one of a wide area network and a cellular network.

The at least one remote server comprises a central monitoring station.

The processor transmits to the central monitoring station at least one of the image and the sensor data.

The processor transmits to the central monitoring station a message comprising information representing at least one of the image and the sensor data.

The mobile device comprises a mobile application.

The mobile application comprises an interface for enabling and disabling remote monitoring by the central monitoring station.

The mobile application comprises an interface for controlling characteristics of the message and transmission of the message.

Embodiments described herein include a monitoring unit comprising a plurality of sensors. The plurality of sensors includes an image sensor. The monitoring unit comprises a network interface. The monitoring unit comprises a processor coupled to the plurality of sensors and the network interface. The monitoring unit comprises at least one application executing on the processor. The processor receives sensor data from the plurality of sensors. The processor generates an alert based upon a change in the sensor data. The alert is sent via the network interface to a mobile device associated with a user.

Embodiments described herein include a monitoring unit comprising: a plurality of sensors, wherein the plurality of sensors include an image sensor; a network interface; a processor coupled to the plurality of sensors and the network interface; and at least one application executing on the processor, wherein the processor receives sensor data from the plurality of sensors, wherein the processor generates an alert based upon a change in the sensor data, wherein the alert is sent via the network interface to a mobile device associated with a user.

Embodiments described herein include a system for remote monitoring. The system comprises a monitoring unit at a premises. The monitoring unit comprises a processor coupled to a plurality of sensors. The plurality of sensors includes an image sensor. The processor includes at least one application executing on the processor. The processor receives sensor data from the plurality of sensors and generates monitoring unit data. The system includes a server and a database located remote to the premises and coupled to the monitoring unit via a network coupling. The server receives the sensor data and the monitoring unit data and stores the sensor data and the monitoring unit data in the database. The server provides access to the sensor data and the monitoring unit data via a mobile device.

Embodiments described herein include a system for remote monitoring, the system comprising: a monitoring unit at a premises, the monitoring unit comprising a processor coupled to a plurality of sensors, wherein the plurality of sensors include an image sensor, wherein the processor includes at least one application executing on the processor, wherein the processor receives sensor data from the plurality of sensors and generates monitoring unit data; and a server and a database located remote to the premises and coupled to the monitoring unit via a network coupling, wherein the server receives the sensor data and the monitoring unit data and stores the sensor data and the monitoring unit data in the database, wherein the server provides access to the sensor data and the monitoring unit data via a mobile device.

The processor generates an alert based upon a change in at least one of the sensor data and the monitoring unit data, wherein the alert is sent to the mobile device.

The system of an embodiment comprises at least one communication module coupled to the processor.

The at least one communication module comprises a home area network (HAN) radio frequency (RF) module.

The at least one communication module comprises a Wi-Fi module.

The executing of the at least one application generates an enrollment process.

The enrollment process automatically places the WiFi module into an Access Point mode.

The mobile device comprises a mobile application, wherein the mobile application enrolls as a client to the Access Point.

The mobile application provides WiFi credentials to the processor via the Access Point.

At least one of the mobile application and the processor initiate storage of the WiFi credentials on the server.

At least one of the server and the processor restore the WiFi credentials from the server.

The mobile application provides authentication against at least one of the processor and a server.

The processor automatically switches the WiFi module to enroll as a client using the WiFi credentials.

The mobile application automatically switches the mobile device to enroll using the WiFi credentials.

The mobile application provides a user interface that includes at least one control for switching the processor to the Access Point mode to change the WiFi credentials.

The mobile application provides to a device location information corresponding to installation of the monitoring unit.

The device comprises the server.

The device comprises at least one of the monitoring unit and at least one additional monitoring unit.

The system of an embodiment comprises an administrative application that provides information about at least one monitoring unit that includes the location information.

The at least one communication module comprises a local area network (LAN) module.

The at least one communication module comprises a cellular data module.

The at least one communication module is coupled to a remote device to communicate with the remote device.

The at least one communication module is coupled to a remote device to communicate over an Internet Protocol (IP) channel.

The at least one communication module is coupled to a remote device to communicate over a cellular channel.

The communication comprises a two-way voice session with the remote device.

The communication comprises a data session, wherein video images are transmitted during the data session.

The remote device comprises the mobile device.

The remote device comprises a central monitoring station.

The communication module automatically establishes a coupling with the plurality of sensors.

The communication module automatically establishes a coupling with a local area network (LAN) at the premises.

The at least one application transfers data between at least one device on the LAN.

The communication module forms a sub-network at the premises.

The sub-network is a private network.

The plurality of sensors are coupled to the sub-network.

Devices couple to the sub-network and communicate over the sub-network, wherein the devices include at least one of wireless devices, wired devices, and IP devices.

The server includes a user account.

The image sensor comprises a camera including a lens.

The camera comprises a lens including a wide-angle geometry, wherein the camera generates images including warped images, wherein the camera generates the images using a wide-angle view mapped to the geometry of the lens from collected images.

The camera comprises an encoder that encodes collected images to generate a processed data stream.

The processed data stream is a compressed video stream.

The system of an embodiment comprises memory coupled to the camera, wherein the camera stores to the memory the processed data stream that includes warped video.

The memory is local to the camera.

The memory is remote to the camera.

The camera streams the processed data stream to a remote device, wherein the remote device comprises at least one of the mobile device and the server.

The camera streams the processed data stream directly to the remote device.

The camera streams the processed data stream to the remote device via at least one intermediary device.

Remote device processes the processed data stream using knowledge of a wide-angle geometry of the lens.

The processing comprises decompressing the processed data stream.

The remote device comprises a software codec, wherein the software codec decompresses the processed data stream.

The remote device comprises a hardware codec, wherein the hardware codec decompresses the processed data stream.

The processing comprises using three-dimensional (3D) rendering and mapping warped video to a 3D space representing at least a portion of the lens geometry.

The processing comprises displaying a 3D view of the collected images via a display coupled to the remote device.

The remote device comprises a user interface comprising control gestures for navigating around the 3D view presented via the display.

The navigating comprises at least one of panning and zooming around the 3D view presented via the display, wherein the control gestures comprise at least one of pinching gestures and swiping gestures.

The camera comprises at least one of a video camera and an imaging camera.

The camera comprises a CMOS sensor and very wide FOV lens.

The system of an embodiment comprises an audio system coupled to the processor.

The system of an embodiment comprises an alarm siren coupled to the processor.

The plurality of sensors comprises a motion sensor.

The motion sensor comprises a passive infrared (PIR) motion sensor with a very wide FOV Fresnel lens.

The plurality of sensors comprises an environmental sensor.

The environmental sensor comprises at least one of a temperature sensor and a humidity sensor.

The plurality of sensors comprises an accelerometer.

The plurality of sensors comprises an ambient light sensor.

The at least one application generates at least one notification corresponding to the alert.

The at least one notification comprises a notification to at least one contact.

The at least one notification comprises one or more of a push message, an electronic mail, a telephone call, and a Short-Message-Service (SMS) message.

The monitoring unit is coupled to one or more accessories.

The accessories are controlled by the monitoring unit data.

The accessories are controlled by a schedule.

The system of an embodiment comprises a rules engine executing on the processor.

The system of an embodiment comprises a mobile application installed on the mobile device.

The mobile application generates a user interface presented on the mobile device, wherein the user interface provides access to at least one of the image and the sensor data.

At least one of the server, the database, and the at least one application are at least one of accessed and controlled using the user interface.

The plurality of sensors are controlled via the user interface.

The system of an embodiment comprises at least one actuator coupled to the processor, wherein the at least one actuator is controlled via the user interface.

The system of an embodiment comprises a heartbeat signal generated by the processor and transmitted to at least one of the server and the mobile device.

The system of an embodiment comprises at least one remote server coupled to at least one of the monitoring unit, the server, and the mobile device.

The coupling comprises at least one of a wide area network and a cellular network.

The at least one remote server comprises a central monitoring station.

The processor transmits to the central monitoring station the monitoring unit data.

The processor transmits to the central monitoring station a message comprising information representing the monitoring unit data.

The mobile device comprises a mobile application.

The mobile application comprises an interface for enabling and disabling remote monitoring by the central monitoring station.

The mobile application comprises an interface for controlling characteristics of the message and transmission of the message.

The system of an embodiment comprises at least one additional monitoring unit at the premises.

The at least one additional monitoring unit is physically separated at the premises from the monitoring unit.

The at least one additional monitoring unit is coupled to the monitoring unit.

The coupling includes at least one of a wired coupling, wireless coupling, WiFi coupling, and IP coupling.

The system of an embodiment comprises forming an integrated security network at the premises by logically combining the at least one additional monitoring unit and the monitoring unit.

At least one of the monitoring unit and the at least one additional monitoring unit comprise an automatic installation process that automatically controls at least one of adding and removing a monitoring unit to the integrated network.

The system of an embodiment comprises a central monitoring station coupled to at least one of the server, the monitoring unit, and the at least one additional monitoring unit.

The monitoring unit and the at least one additional monitoring unit are monitored and controlled from the mobile device.

The monitoring unit and the at least one additional monitoring unit are monitored and controlled from the mobile device.

The server comprises a user account that corresponds to the monitoring unit and the at least one additional monitoring unit.

Embodiments described herein include a system for remote monitoring. The system comprises a monitoring unit at a premises. The monitoring unit comprises a processor coupled to a camera and a network interface. The processor includes at least one application executing on the processor. The processor receives monitoring unit data that includes images from the camera and sensor data from one or more sensors. The system includes a server located remote to the premises and coupled to the monitoring unit via the network interface. The server is coupled to a database. The server receives monitoring unit data from the monitoring unit and stores the monitoring unit data in the database. The server provides access to the monitoring unit data via a mobile device associated with a user.

Embodiments described herein include a system for remote monitoring, the system comprising: a monitoring unit at a premises, the monitoring unit comprising a processor coupled to a camera and a network interface, wherein the processor includes at least one application executing on the processor, wherein the processor receives monitoring unit data that includes images from the camera and sensor data from one or more sensors; and a server located remote to the premises and coupled to the monitoring unit via the network interface, wherein the server is coupled to a database, wherein the server receives monitoring unit data from the monitoring unit and stores the monitoring unit data in the database, wherein the server provides access to the monitoring unit data via a mobile device associated with a user.

Embodiments described herein include a system for remote monitoring. The system comprises a monitoring unit at a premises. The monitoring unit comprises a processor coupled to a plurality of sensors. The plurality of sensors includes an image sensor. The processor includes at least one application executing on the processor. The processor receives sensor data from the plurality of sensors and generates monitoring unit data. The system includes a server and a database located remote to the premises and coupled to the monitoring unit via a network coupling. The server receives the sensor data and the monitoring unit data and stores the sensor data and the monitoring unit data in the database. The server provides access to the sensor data and the monitoring unit data via a mobile device.

Embodiments described herein include a system for remote monitoring, the system comprising: a monitoring unit at a premises, the monitoring unit comprising a processor coupled to a plurality of sensors, wherein the plurality of sensors include an image sensor, wherein the processor includes at least one application executing on the processor, wherein the processor receives sensor data from the plurality of sensors and generates monitoring unit data; and a server and a database located remote to the premises and coupled to the monitoring unit via a network coupling, wherein the server receives the sensor data and the monitoring unit data and stores the sensor data and the monitoring unit data in the database, wherein the server provides access to the sensor data and the monitoring unit data via a mobile device.

Although certain methods, apparatus, computer readable memory, and articles of manufacture have been described herein, the scope of coverage of this disclosure is not limited thereto. To the contrary, this disclosure covers all methods, apparatus, computer readable memory, and articles of manufacture fairly falling within the scope of the appended claims either literally or under the doctrine of equivalents.

Although the following discloses example methods, system and apparatus including, among other components, software executed on hardware, it should be noted that such methods, system and apparatus are merely illustrative and should not be considered as limiting. For example, it is contemplated that any or all of these hardware and software components could be embodied exclusively in hardware, exclusively in software, exclusively in firmware, or in any combination of hardware, software, and/or firmware. Accordingly, while the following describes example methods and apparatus, persons having ordinary skill in the art will readily appreciate that the examples provided are not the only way to implement such methods, system and apparatus.

Computer networks suitable for use with the embodiments described herein include local area networks (LAN), wide area networks (WAN), Internet, or other connection services and network variations such as the world wide web, the public internet, a private internet, a private computer network, a public network, a mobile network, a cellular network, a value-added network, and the like. Computing devices coupled or connected to the network may be any microprocessor controlled device that permits access to the network, including terminal devices, such as personal computers, workstations, servers, mini computers, main-frame computers, laptop computers, mobile computers, palm top computers, hand held computers, mobile phones, TV set-top boxes, or combinations thereof. The computer network may include one of more LANs, WANs, Internets, and computers. The computers may serve as servers, clients, or a combination thereof.

The embodiments described herein can be a component of a single system, multiple systems, and/or geographically separate systems. The embodiments described herein can also be a subcomponent or subsystem of a single system, multiple systems, and/or geographically separate systems. The embodiments described herein can be coupled to one or more other components (not shown) of a host system or a system coupled to the host system.

One or more components of the embodiments described herein and/or a corresponding system or application to which the embodiments described herein is coupled or connected includes and/or runs under and/or in association with a processing system. The processing system includes any collection of processor-based devices or computing devices operating together, or components of processing systems or devices, as is known in the art. For example, the processing system can include one or more of a portable computer, portable communication device operating in a communication network, and/or a network server. The portable computer can be any of a number and/or combination of devices selected from among personal computers, personal digital assistants, portable computing devices, and portable communication devices, but is not so limited. The processing system can include components within a larger computer system.

The processing system of an embodiment includes at least one processor and at least one memory device or subsystem. The processing system can also include or be coupled to at least one database. The term "processor" as generally used herein refers to any logic processing unit, such as one or more central processing units (CPUs), digital signal processors (DSPs), application-specific integrated circuits (ASIC), etc. The processor and memory can be monolithically integrated onto a single chip, distributed among a number of chips or components, and/or provided by some combination of algorithms. The methods described herein can be implemented in one or more of software algorithm(s), programs, firmware, hardware, components, circuitry, in any combination.

The components of any system that includes the embodiments described herein can be located together or in separate locations. Communication paths couple the components and include any medium for communicating or transferring files among the components. The communication paths include wireless connections, wired connections, and hybrid wireless/wired connections. The communication paths also include couplings or connections to networks including local area networks (LANs), metropolitan area networks (MANs), wide area networks (WANs), proprietary networks, interoffice or backend networks, and the Internet. Furthermore, the communication paths include removable fixed mediums like floppy disks, hard disk drives, and CD-ROM disks, as well as flash RAM, Universal Serial Bus (USB) connections, RS-232 connections, telephone lines, buses, and electronic mail messages.

Aspects of the embodiments described herein and corresponding systems and methods described herein may be implemented as functionality programmed into any of a variety of circuitry, including programmable logic devices (PLDs), such as field programmable gate arrays (FPGAs), programmable array logic (PAL) devices, electrically programmable logic and memory devices and standard cell-based devices, as well as application specific integrated circuits (ASICs). Some other possibilities for implementing aspects of the embodiments described herein and corresponding systems and methods include: microcontrollers with memory (such as electronically erasable programmable read only memory (EEPROM)), embedded microprocessors, firmware, software, etc. Furthermore, aspects of the embodiments described herein and corresponding systems and methods may be embodied in microprocessors having software-based circuit emulation, discrete logic (sequential and combinatorial), custom devices, fuzzy (neural) logic, quantum devices, and hybrids of any of the above device types. Of course the underlying device technologies may be provided in a variety of component types, e.g., metal-oxide semiconductor field-effect transistor (MOSFET) technologies like complementary metal-oxide semiconductor (CMOS), bipolar technologies like emitter-coupled logic (ECL), polymer technologies (e.g., silicon-conjugated polymer and metal-conjugated polymer-metal structures), mixed analog and digital, etc.

It should be noted that any system, method, and/or other components disclosed herein may be described using computer aided design tools and expressed (or represented), as data and/or instructions embodied in various computer-readable media, in terms of their behavioral, register transfer, logic component, transistor, layout geometries, and/or other characteristics. Computer-readable media in which such formatted data and/or instructions may be embodied include, but are not limited to, non-volatile storage media in various forms (e.g., optical, magnetic or semiconductor storage media) and carrier waves that may be used to transfer such formatted data and/or instructions through wireless, optical, or wired signalling media or any combination thereof. Examples of transfers of such formatted data and/or instructions by carrier waves include, but are not limited to, transfers (uploads, downloads, e-mail, etc.) over the Internet and/or other computer networks via one or more data transfer protocols (e.g., HTTP, FTP, SMTP, etc.). When received within a computer system via one or more computer-readable media, such data and/or instruction-based expressions of the above described components may be processed by a processing entity (e.g., one or more processors) within the computer system in conjunction with execution of one or more other computer programs.

Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise," "comprising," and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in a sense of "including, but not limited to." Words using the singular or plural number also include the plural or singular number respectively. Additionally, the words "herein," "hereunder," "above," "below," and words of similar import, when used in this application, refer to this application as a whole and not to any particular portions of this application. When the word "or" is used in reference to a list of two or more items, that word covers all of the following interpretations of the word: any of the items in the list, all of the items in the list and any combination of the items in the list.

The above description of embodiments and corresponding systems and methods is not intended to be exhaustive or to limit the systems and methods to the precise forms disclosed. While specific embodiments of, and examples for, the embodiments and corresponding systems and methods are described herein for illustrative purposes, various equivalent modifications are possible within the scope of the systems and methods, as those skilled in the relevant art will recognize. The teachings of the embodiments described herein and corresponding systems and methods provided herein can be applied to other systems and methods, not only for the systems and methods described above.

The elements and acts of the various embodiments described above can be combined to provide further embodiments. These and other changes can be made to the integrated security system and corresponding systems and methods in light of the above detailed description.

In general, in the following claims, the terms used should not be construed to limit the integrated security system and corresponding systems and methods to the specific embodiments disclosed in the specification and the claims, but should be construed to include all systems that operate under the claims. Accordingly, the integrated security system and corresponding systems and methods is not limited by the disclosure, but instead the scope is to be determined entirely by the claims.

While certain aspects of the embodiments described herein and corresponding systems and methods are presented below in certain claim forms, the inventors contemplate the various aspects of the embodiments described herein and corresponding systems and methods in any number of claim forms. Accordingly, the inventors reserve the right to add additional claims after filing the application to pursue such additional claim forms for other aspects of the embodiments described herein and corresponding systems and methods.

What is claimed is:

1. A monitoring system comprising:

a camera comprising a lens, wherein the camera generates one or more lens-warped images;

a network;

a processor of a device that is remote from the camera and coupled to the camera using the network;

at least one application including one or more program instructions stored in one or more memory devices accessible to the processor of the remote device, wherein the one or more program instructions, when executed by the processor of the remote device, cause the processor of the remote device to:

receive (i) the one or more lens-warped images from the camera and (ii) sensor data from at least one sensor coupled to the processor of the remote device,

map the one or more lens-warped images to a three-dimensional space representing geometry of the lens, and

generate an alert based upon a detected change in the sensor data, and provide, using the network, (i) the one or more mapped images and (ii) the generated alert to a mobile device for display on a display of the mobile device.

2. The monitoring system of claim **1**, wherein the monitoring system further comprises at least one communication module coupled to the processor,

wherein the at least one communication module comprises a Wi-Fi module,

wherein the one or more instructions of the at least one application, when executed by the processor, cause the processor to generate an enrollment process,

wherein the enrollment process automatically places the WiFi module into an Access Point mode,

wherein the mobile device comprises a mobile application, wherein the mobile application enrolls as a client to the Access Point,

wherein the mobile application provides WiFi credentials to the processor via the Access Point, and

wherein the mobile application provides authentication against at least one of the processor and a remote server.

3. The monitoring system of claim **2**, wherein at least one of the mobile application and the processor initiate storage of the WiFi credentials on a remote storage device.

4. The monitoring system of claim **3**, wherein at least one of the remote server and the processor restore the WiFi credentials from the remote storage device.

5. The monitoring system of claim **1**, wherein the remote device comprises a remote server.

6. The monitoring system of claim **1**, wherein the remote device comprises a monitoring unit.

7. The monitoring system of claim **1**, wherein the camera includes at least one communication module that is configured to communicate with the remote device.

8. The monitoring system of claim **7**, wherein the at least one communication module is to communicate with the remote device over an Internet Protocol (IP) channel.

9. The monitoring system of claim **7**, wherein the at least one communication module is to communicate with the remote device over a cellular channel.

10. The monitoring system of claim 7, wherein the communication comprises a two-way voice session with the remote device.

11. The monitoring system of claim 10, wherein the communication comprises a data session, wherein the one or more lens-warped images are transmitted during the data session.

12. The monitoring system of claim 7, wherein the remote device comprises a central monitoring station computer.

13. The monitoring system of claim 1, wherein the remote device includes a communication module that automatically establishes a coupling with the at least one sensor.

14. The monitoring system of claim 1, wherein the remote device includes a communication module automatically establishes a coupling with the network, wherein the network includes a local area network (LAN) at a premises.

15. The monitoring system of claim 1, wherein the at least one sensor comprises a motion sensor.

16. The monitoring system of claim 15, wherein the motion sensor comprises a passive infrared (PIR) motion sensor with a very wide FOV Fresnel lens.

17. The monitoring system of claim 1, wherein the at least one sensor comprises an environmental sensor.

18. The monitoring system of claim 17, wherein the environmental sensor comprises at least one of a temperature sensor and a humidity sensor.

19. The monitoring system of claim 1, wherein the at least one sensor comprises an accelerometer.

20. The monitoring system of claim 1, wherein the at least one sensor comprises an ambient light sensor.

21. The monitoring system of claim 1, wherein the at least one application generates the alert.

22. The monitoring system of claim 21, wherein the alert comprises one or more of a push message, an electronic mail, a telephone call, a Short-Message-Service (SMS) message, a notification to at least one contact.

23. The monitoring system of claim 1, comprising a rules engine executing on the processor of the remote device.

24. The monitoring system of claim 1, comprising a mobile application installed on the mobile device.

25. The monitoring system of claim 24, wherein the mobile application generates a user interface presented on the mobile device, wherein the user interface provides access to the interactive streaming video feed and the sensor data.

26. The monitoring system of claim 25, wherein the mobile application is at least one of accessed and controlled using the user interface.

27. The monitoring system of claim 25, wherein the at least one sensor is controlled via the user interface.

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